VOL. 174 NO. 4 AMERICAN APRIL, 1951

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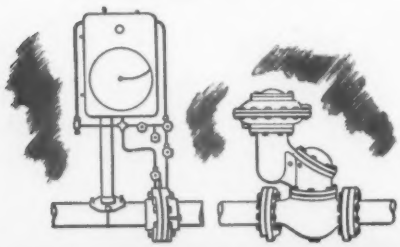

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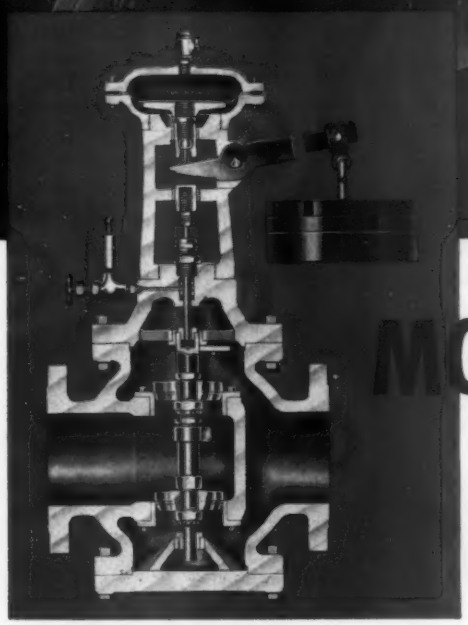

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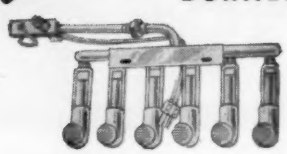

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AMERICAN Gas Journal
ESTABLISHED 1859

VOLUME 174 APRIL 1951 NUMBER 4

This month...

Well, it takes all kinds of opinions to make a consensus. On the subject of a February editorial, "Keep Gas Ranges Gas," Leon Ourusoff, of Washington Gas Light Co., feels that we invite the industry to take a one-sided position with respect to automatic range ignition. He advises further that "a good electrical igniting device on a gas range does not make it dependent upon electricity, since in case of power failure all you have to do is apply a match to the pilot after turning your oven or broiler valve," and from there on everything works like a charm.

But then, Claude Hazel, of The Philadelphia Gas Works Co., says: "We want to take this means of congratulating you on this fine piece of work [the same editorial we are talking about] and to say that we appreciate . . . your magazine taking a definite stand on the gas range oven ignition problem." As embattled exponents of the Definite Stand we still say Keep Gas Ranges Gas.

An up and coming press agent who had better be nameless since he has a good bread and butter account in the gas industry seems also to have been swayed by our plausible guile. He observes that he enjoyed our editorials on GAMA's public relations program, and poses a question or two of his own: "Did it ever occur to you that GAMA is the only outfit in the industry capable of such a decision? Doesn't your heart bleed at times for an industry that is so effectively controlled by its opposition . . . that has so many of its competitors in high places in its own councils?" We have noticed a slight saffron suffusion over our left ventricle, but an innate sense of self-preservation has cautioned against making any public display of the malady.

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Howard F. Weeks • Associate Editor
Charles R. Bellamy • Technical Editor
Arthur Rohman • Western Editor **John F. Falvey • Financial Editor**

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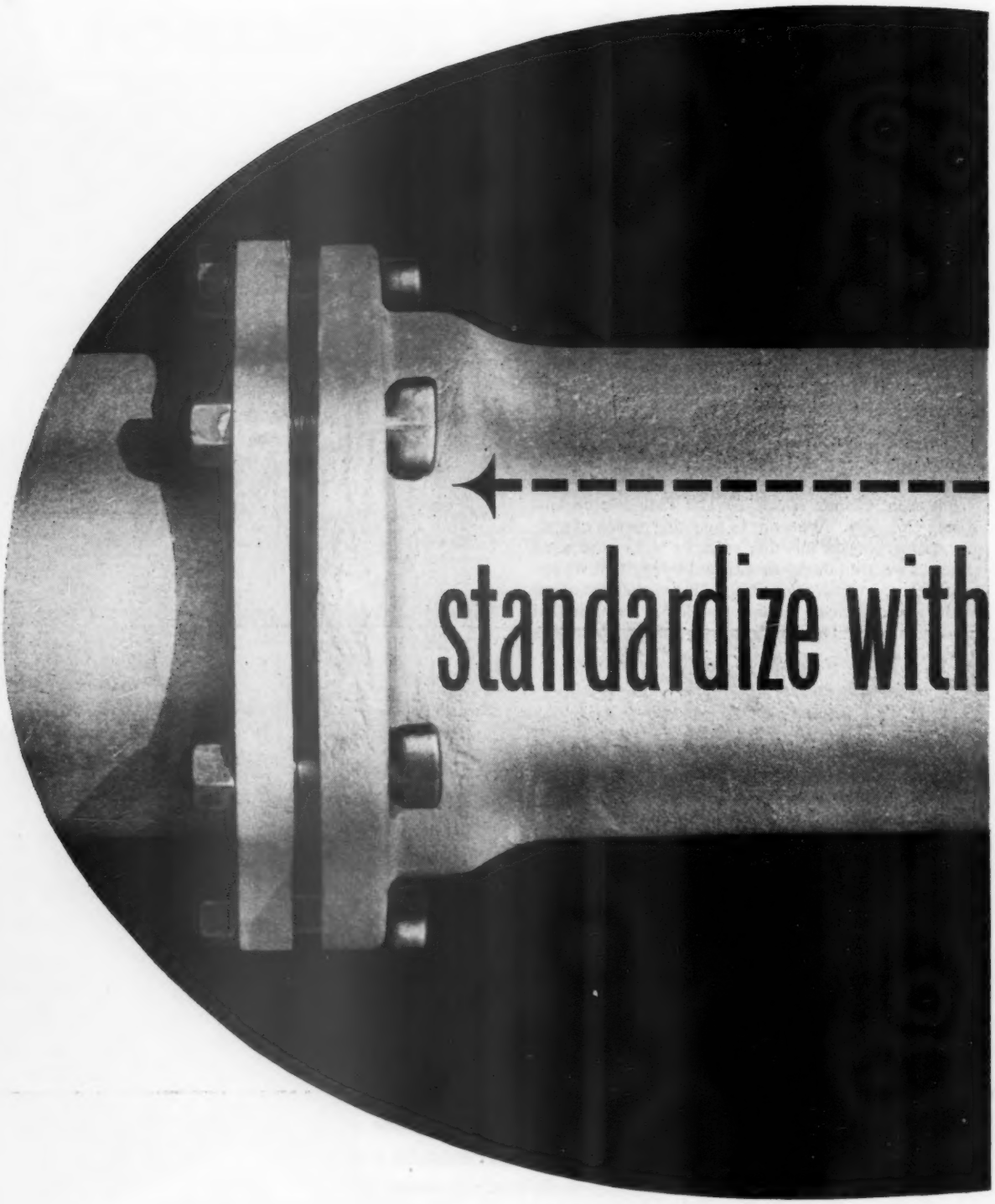
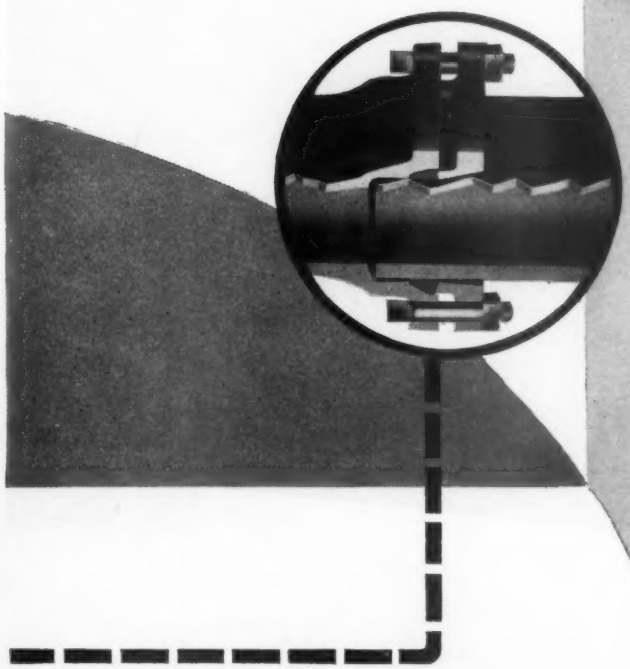


Many important gas utilities have *standardized on standardized mechanical joint cast iron pipe* for new mains carrying all types of gas at low, intermediate and high pressures.

Cast Iron Pipe Research Association, T. F. Wolfe, Managing Director, Peoples Gas Bldg., Chicago 3.



The gas industry in America has a history of about 120 years. Its foundation was literally based on cast iron distribution mains, many of the earliest of them still in service. But to the economy of long life, mechanical joint cast iron pipe adds economy in laying costs. Listen! Mechanical joint cast iron pipe costs less to lay because more footage

standardized mechanical joint

CAST IRON PIPE

can be laid per day with less equipment —with less delays in wet weather— and with less trouble with wet trenches. The joints are bottle-tight. Standardized and interchangeable accessories and fittings are a much appreciated feature. All these advantages have been conclusively demonstrated in the construction of distribution mains for all types of gas at low, intermediate and high pressures, in all parts of the nation.

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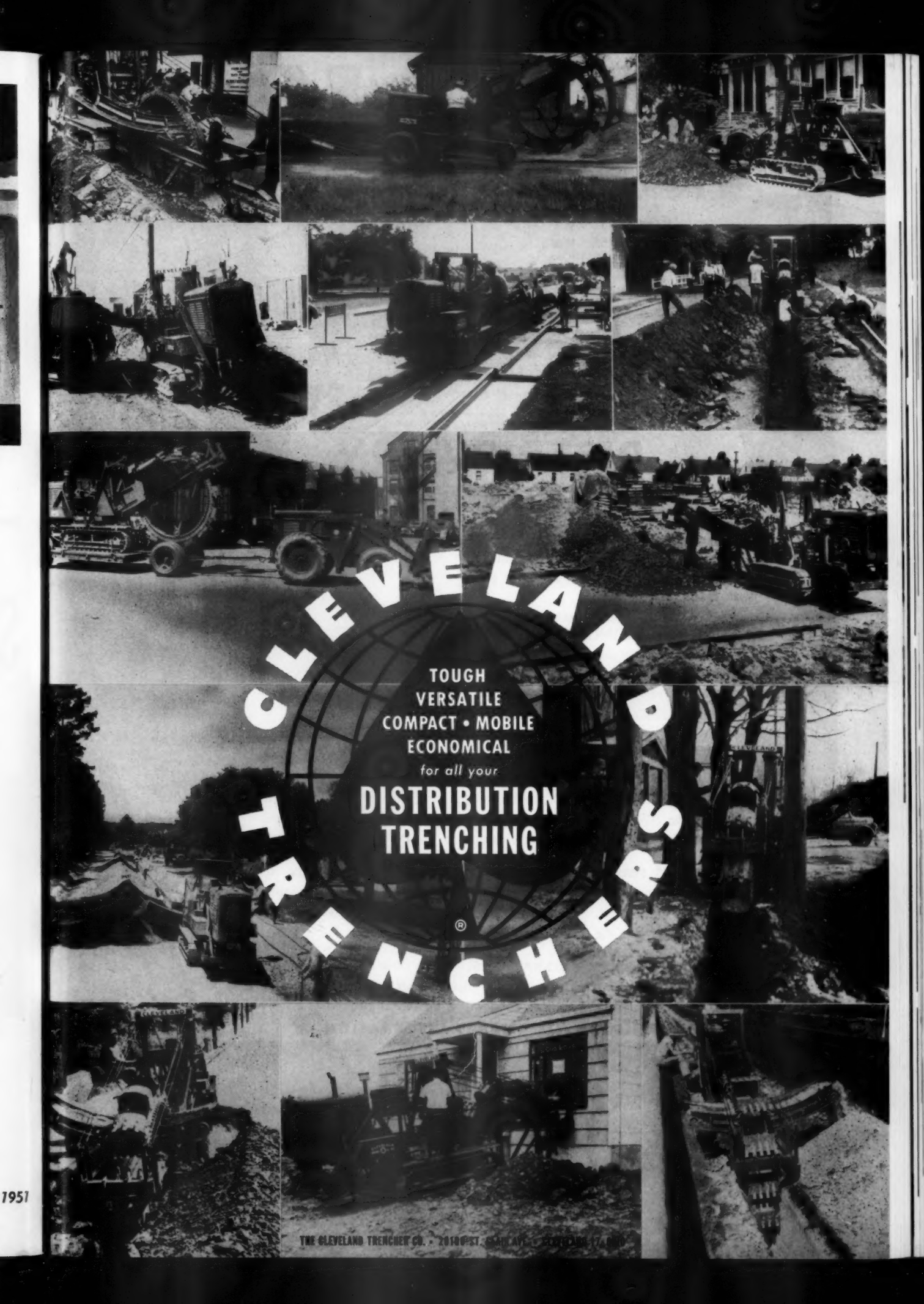
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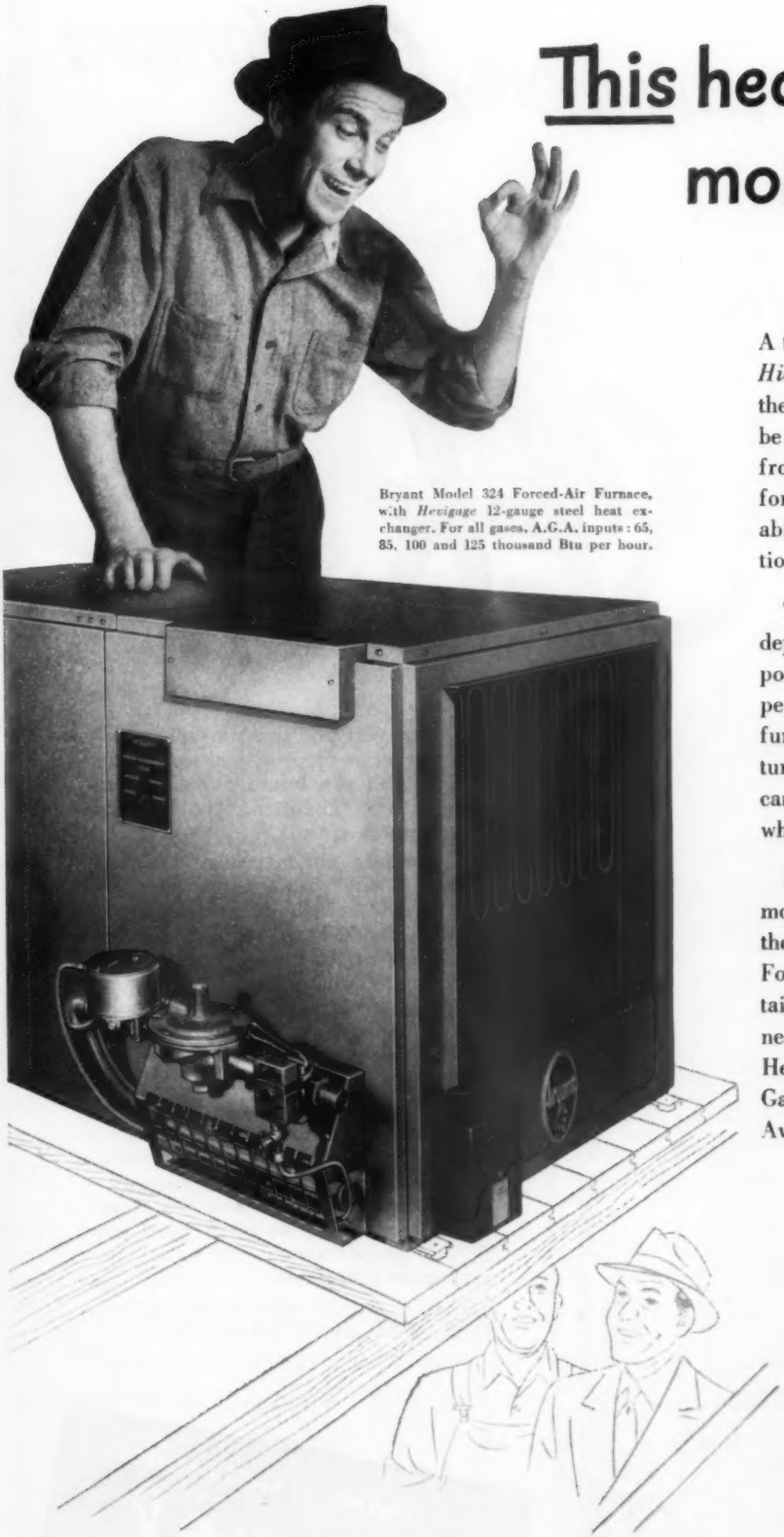

Bryant Model 324 Forced-Air Furnace, with *Hevigage* 12-gauge steel heat exchanger. For all gases, A.G.A. inputs: 65, 85, 100 and 125 thousand Btu per hour.

A truly great space saver like the Bryant *Hide-away* Forced-Air Furnace helps sell the idea of home heating *with gas*. It can be tucked away in the attic or suspended from ceiling or under the floor, releasing for storage, utility or *living* all the valuable space usually occupied by conventional heating equipment!

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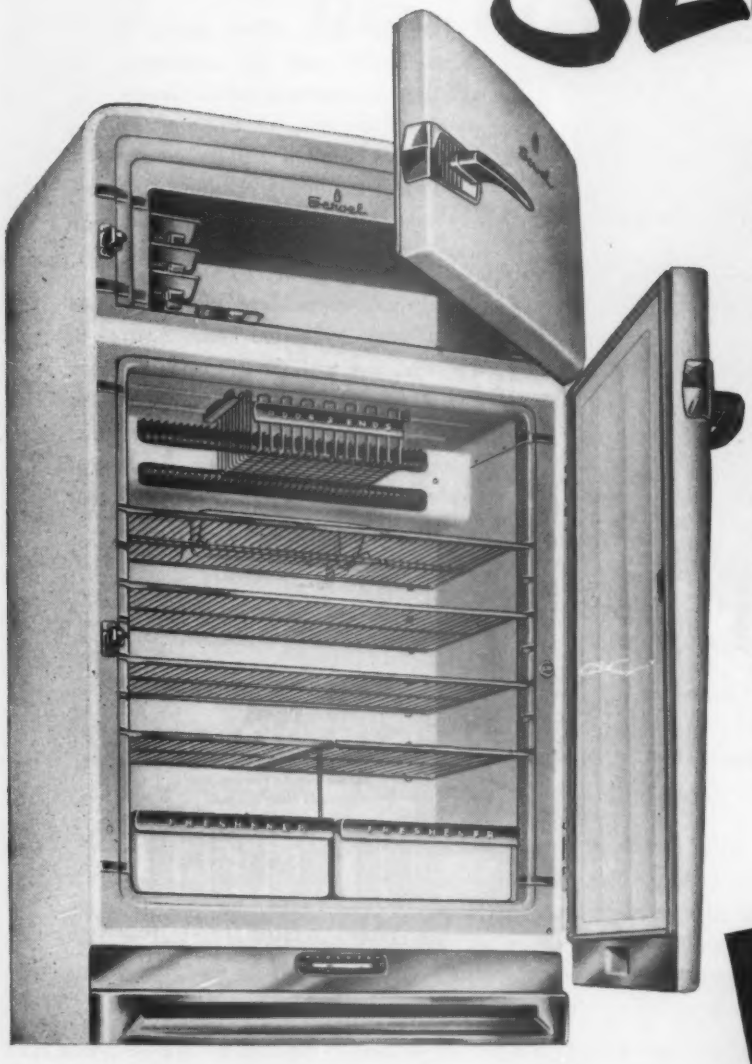

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And, of course, every customer will know about Servel's famous motorless freezing system. The "no moving parts" system that means years of silent, dependable service. So stock the Royal Tudor, and all seven other great new Servels. Show them . . . and watch your customers buy them.

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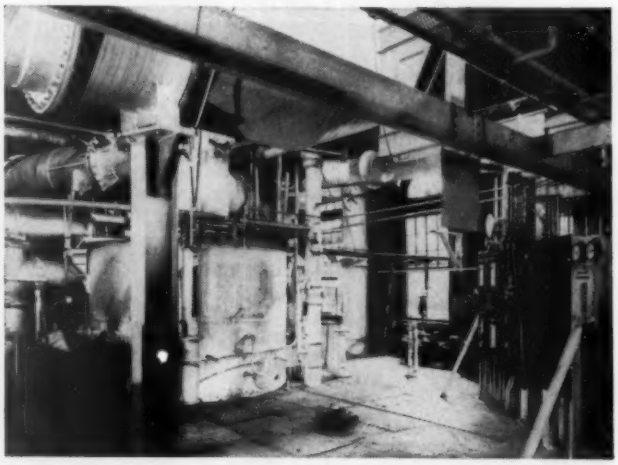

Existing No. 16-11'-O" Carburetted Water Gas Set modified for U.G.I. Cyclic Catalytic Reforming Process, Station "A", the Philadelphia Gas Works Company.

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Construction of Distribution Main Extensions at Syracuse, N.Y. for Niagara Mohawk Power Corporation.

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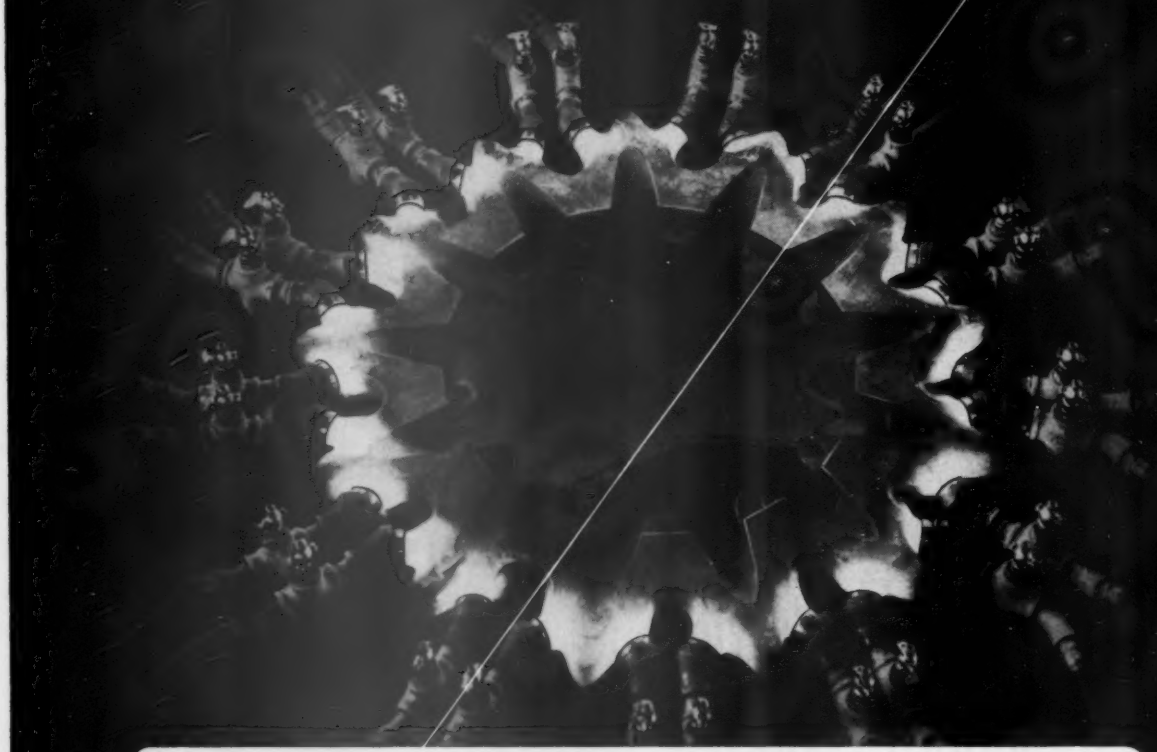

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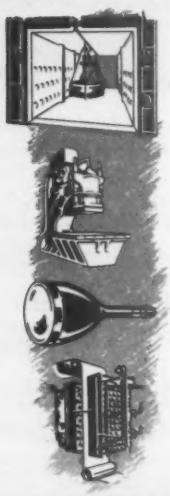

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Editorial:

Holley Poe

IN the passing of E. Holley Poe the natural gas industry has lost one of its doughtiest champions, and a most convincing and voluble spokesman.

To many persons, within the industry and outside of it, he symbolized more than any other single individual the imagination, the vision and the opportunities associated with natural gas expansion. He had enjoyed the personal satisfaction of seeing Texas Eastern, the company that he organized, become the first to bring natural gas from Texas to the Atlantic Seaboard.

In the cavalier manner typical of contemporary journalism, this feat was appraised by the public press largely in terms of the financial gains that accrued to the early participants in the project. Yet those who knew Holley Poe well, realized that to him it was first of all the rich fulfillment of a dream of many years.

In the years prior to the war, when merely to mention Texas natural gas was to court disfavor in many manufactured gas circles, his persistent and unquenchable theme was "natural gas is coming." Under his leadership, as secretary of the then natural gas section of the American Gas Association, he strengthened and solidified the ranks of natural gas operators to the end that their important branch of the industry later became a full department in the association.

Called to Washington to head the natural gas and natural gasoline division of the Petroleum Administration for War, he was able within a matter of weeks to build a spirit of cooperative and harmonious relations between the gas industry and PAW; which was no mean task with Harold Ickes at the helm.

As consultant to the gas industry committee during the Federal Power Commission's well remembered Docket G-580 investigations, he succeeded, as far as anyone could or probably ever will succeed, in reconciling the divergent and conflicting views of natural gas men as to the subject matter that should be presented for incorporation in the formal records of the hearings. No man to yield in supine subjection to Federal encroachment on fields of regulation outside its purview, he nevertheless was both preacher and practicer of the policy of reasoned discussion as opposed to violent and futile defiance of regulatory edicts.

Just as he had been first to conceive and propound a workable plan to convert the government oil lines to the transportation of natural gas, so also had he taken the lead in championing the cause of natural gas for New England, and of a line to carry gas from Alberta, Canada, into the Pacific northwest.

If Holley Poe were here today, he would laugh at the suggestion that he may have been considered a genius. Yet if imagination, and unquenchable optimism, and confidence in himself and belief in the fundamental integrity of his fellow man are any of them the habiliments of greatness, he was at least clothed in the garments that genius may wear.

The gas industry may well salute the memory of its happiest warrior, conquered only by death.

Elliott Taylor

Few Problems Are Now Standing in Way Of Gas Turbine Technical Supremacy

by C. T. Konecny

Columbia Engineering Corp., Columbus, Ohio

THE gas turbine, as in the case of most prime movers, has had a rather long history. It is, however, a new prime mover in being reduced to a form suitable for practical applications.

A gas turbine unit may take a great many forms, and throughout the world various designs have been built and more are underway. These range from the simplest cycle type to very complex cycle types which may involve both reciprocating and rotating equipment. These various types have their attractive features, although of only recent development.

At present it is impossible to give firm facts and figures on the use of gas turbines as stationary units, as there are practically no past achievements and therefore few present trends.

During the war years it was the aeronautical application which received practically the whole of the gas turbine effort available, and now its acceptance as a high aircraft power plant is well established as it does a better job than any competitive power plant. The end of the war, therefore, left us with a highly developed aeronautical gas turbine industry but little or nothing on the industrial side; therefore, the industrial gas turbine has had to start practically from scratch during the past few years.

Much has been written concerning the broad field available to the gas turbine as its development progresses, and it does seem to be a type of power plant which will prove to be of wide usefulness. The gas turbine should prove its adaptability in two ways: first, even the simplest type of plant is attractive for many applications without changing the basic unit; second, as the over-all development progresses, further new types should become available with their own particular fields of superiority.

A simple cycle gas turbine unit is one consisting of the combustor and compressor-driven gas turbine unit, which gives a moderate over-all thermal efficiency and can be used where cheap fuel is available and there is a scarcity of water. Usually in power generation a higher thermal efficiency at full load and at part load is desirable, especially with more expensive fuels, and therefore a more complex cycle is required by using heat transfer elements in the form of intercoolers between stages of compression and regenerators, thus making use of the turbine exhaust heat to preheat the air entering the combustor chambers.

The realization of high thermal efficiencies on gas turbine units depends largely on the employment of high temperatures entering the turbine and the development of suitable metals or refractories to withstand these high temperatures while the turbine is revolving at high speed. Encouraging progress is being made in these researches. It also should be remembered that the capacity and efficiency of a gas turbine improves with a decrease in the inlet-air temperatures. Hence, such units are favored for winter operation or operation in cold climates.

Many engineers also overlook the fact that the gas turbine is a torque multiplier. It is one of the few prime movers that is capable of producing high starting torque at low speed. The turbine exerts its maximum torque at zero speed.

The Power Station

In the stationary power generating field the gas turbine plant and the steam turbine plant may be compared on an economic basis by arbitrarily assuming that the life, maintenance and reliability characteristics can be made equal, leaving first cost and cost of power generation as the predominant factors. Such an analysis of steam and gas turbine plants of current design indicates that the present day gas turbine has economic application possibilities in the stationary power generation field whenever the price of fuel is sufficiently low or the load factor is less than 10 per cent, and then only when the gas turbine plant first cost is relatively low.

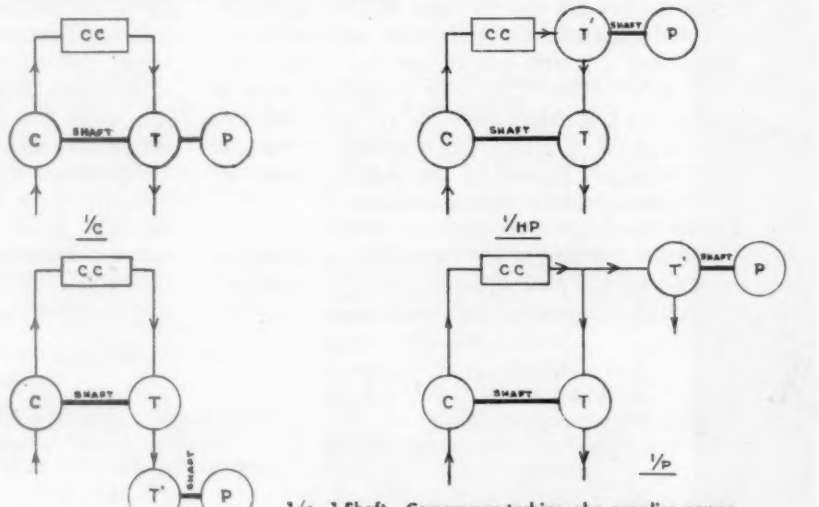


Fig. 1. Single turbo-compressor rotor—four positions for power turbine.

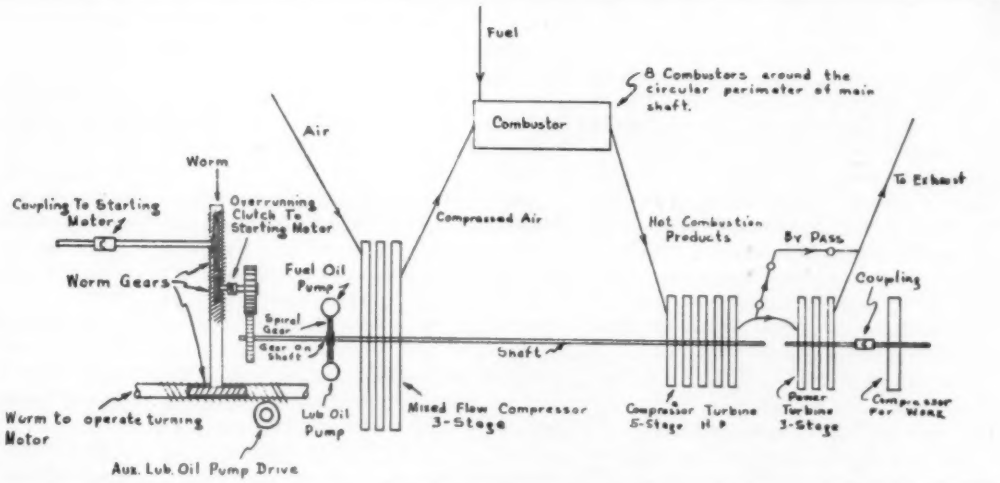


Fig. 2. Gas Turbine Power Plant

Design conditions

Ambient temperature—68° F.
Barometric Pressure—14.7 psia.
Overall pressure ratio—6:1.
Turbine inlet temperature—1300° F.
Air delivery—44500 cfm at 7900 rpm.
Power developed—3000 bhp. at 4200 rpm.

It appears that the gas turbine plant will initially serve the stationary power generation field not by challenging the steam plant but by supplementing it as a stand-by for peak load service.

There are very few locations in the world that present the same attractive combination of low fuel cost and large industrial electric power consumption as the cities located near our southern oil and gas fields. The availability of gas at one-third to one-fifth the cost of coal makes this an attractive territory for the economic installation of gas turbine plants. Low fuel costs permit the use of simple cycle plants that are very desirable as initial installations of a new type of plant. Announcement has been made of two small gas turbine generating units to be installed in this territory.

In this country first cost and efficiency considerations indicate that at present the gas turbine is not competitive with the Diesel engine for the generation of electricity in sizes below 3000 kw. However, there appears to be a real place for gas turbines in sizes from 3000 to 25,000 kw. Several American utilities are now considering gas turbines for peak operation in load centers at the distant ends of their transmission lines.

It is an almost unanimous opinion, both here and abroad, that there remains much work in research and development before the gas turbine can be considered as a practical and economic power plant for base-load power generation in competition with coal fired steam plants.

The Locomotive

Perhaps the most interesting gas turbine application from the technical point of view is that of the railway locomotive.

Operating on the simple cycle, the gas turbine locomotives will have a higher fuel consumption than its main competitor, the Diesel. Its principal advantages over the Diesel will be a lower weight and higher horsepower per foot of train length. The present indications are that the gas turbine will be cheaper to make and maintain and will have greater reliability and a longer life than the Diesel.

Industrial Power

Many arrangements of the components of a gas turbine unit are theoretically possible not only to care for designed conditions but also for part-load operation as to the positioning of the compressors and turbines, with or without the inclusion of heat exchangers, intercoolers and reheat chambers in order to improve the thermal efficiency of the unit. The gas turbine unit thermal efficiency will vary from 17 to above 30 per cent, depending on the heat recovery, and this can be compared with 10 per cent thermal efficiency for the reciprocating steam engine, 22 per cent for the gasoline engine, 30 per cent for the steam turbine and 35 per cent for the Diesel engine.

For industrial application the single turbo-compressor rotor would probably be used where four possible positions for the components are considered. Figure 1 shows 1/c—which at constant temperature the speed of the power turbine cannot be varied, 1/LP and 1/HP—where the power speed relationship of the power turbine can vary without unduly altering the equilibrium of the other components, and 1/P—which has the advantage of 1/LP and 1/HP, but at the same time obtains turbine operating temperatures which are more or less midway between those typical of the part-load performances of similar 1/LP and 1/HP designs.

The turbo-compressor can be of the axial, radial centrifugal or the mixed flow designs. Axial flow imposes conditions on their driver similar to those of radial centrifugal machines. The advantages and disadvantages of the axial flow and radial centrifugal compressors can briefly be summarized as follows:

(1) Weight and space factors favor the axial.

(2) The axial has a relatively high compression efficiency when handling large volumes and is adaptable to relatively high discharge temperatures. The efficiencies of axial will run 80-85 per cent while radial will only average around 70-74 per cent. This is due to greater flow disturbances in the radial because the vanes cannot be (or at least have not been) given the airfoil shape, and also to more leakage across the impeller of a radial than across the rotor of an axial for the same pressure conditions.

(3) High volume or conversely relatively high rotative speed for commonly encountered inlet volumes favor the axial.

(4) A steep pressure volume characteristic for the axial in contrast to the relatively flat pressure volume characteristic for the radial. In other words, the axial is better adapted to fixed volume applications or where the volume varies over a narrow range, or where a relatively wide range of pressure ratio or head is desirable.

(5) The radial is best adapted to handling wide variation in volume, where the variation in pressure ratio or head is not of great magnitude. This is because for every speed there is a certain quantity below which the operation will be unstable. This surging or pumping limit is one of the disadvantages of the axial flow design, as its tendency to surge or pulsate, especially with steep-pitch propellers, is located at from 50 to 80 per cent of the design capacity. Radial centrifugals also have a surging or pulsation range, but at only 20 to 30 per cent of normal output, a percentage of rating which for most applications is below the useful demand.

(6) Temperature stresses due to the axial not having solid diaphragms extending across the shell are not as great

as for the radial type, and for this reason water cooling is more often employed with the radial centrifugals.

Each of these types of compressors will find particular applications, but to date, with a substantially fixed resistance at the compressor end of a constant output gas turbine, less weight and better thermal efficiency, the axial flow type has been prevalent; although, now there appears in many applications a tendency to use the mixed flow design in order that the range of operation at high speed lies between those of the axial and radial centrifugal types.

An industrial application of a turbo-compressor unit is shown in Figure II. This unit has been under shop test.

The design conditions chosen for this unit were an ambient air temperature of 68° F., a barometric pressure of 14.7 psia, an over-all pressure ratio of 6:1, and a turbine inlet temperature of 1300° F. with an output of 3000 bhp.

The high pressure axial flow type turbine drives the compressor and the auxiliary equipment. The compressor of mixed flow design delivers 44,500 cfm at 7900 rpm to the combustors of multiple type, oil being the fuel, and the hot products of combustion from the combustors enter the compressor gas turbine at 1300° F., where they are expanded at high velocity. The power turbine in series with the compressor-turbine unit operates on an independent shaft and is designed to develop 3000 bhp at 4200 rpm. The power turbine is also provided with a by-pass around to the turbine exhaust, which is to be used during idling operation. Thrust bearings are on both the main and the power turbine shafts to care for any horizontal movement. The over-all thermal efficiency of this power unit is 17.5 per cent.

Due to the independent shafts used in this unit, the power load can remain at constant speed while the compressor and its turbine are brought to their most desirable speed.

The manner in which this plant is controlled is, of course, dependent upon the requirements of the driven load but may, in general, be said to be speed controlled from the power turbine to the fuel supply with a maximum temperature limiting device as a safe guard for the high pressure turbine.

The power turbine, which can be directly connected to the work through reduction or increasing speed gears, will operate at speeds from zero to maximum, as this type of turbine produces its maximum torque at zero speed. The compressor-turbine wheel, however, operates at nearly constant speed. Thus the compressor and its turbine act as a producer of high pressure temperature gas. Control is effected by reducing the speed of the compressor-turbine, thereby reducing the pressure ratio, temperature and air flow through the unit. The speed reduction of the gas produced need not be large to accomplish adequate control. A change in speed of the compressor of less than 20 per cent will permit operation of the power turbine over its full range of speed.

Such units in time may be economical to replace the electric drive now used on centrifugal compressors (each compressor impeller giving approximately a 1.2 pressure ratio) for the transmission of natural gas or where large volume of compressed air is required, and as a stand-by or peak load power unit in industrial plants, by driving the generator and motors through reducing gears to normal speeds of 750 to 3600 rpm as conditions require.

The constant pressure compressor-turbine unit on one shaft, due to its inherent simplicity with no water requirements and presumably low first cost, can offset its low thermal efficiency (17-18 per cent) and, therefore, should find some practical industrial applications. Both General Electric and Westinghouse have run their design units through severe testing with very encouraging results.

The General Electric Co. has now contracted to install a 5500 hp gas turbine for the Tennessee Gas Transmission Co. at one of their pumping stations.

The Westinghouse Electric Corp. has already installed and had in operation a 2000 hp gas turbine for the Mississippi River Fuel Corp. at Wilmar, Arkansas, midway between St. Louis and the Louisiana oil fields, to pump natural gas through a 22" pipe line.*

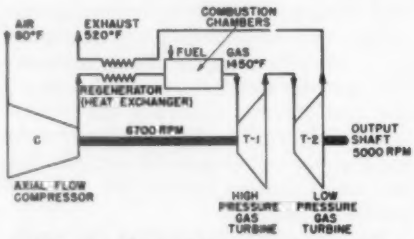


Fig. 3. Flow diagram of a gas-turbine system with heat generator.

Within the past year considerable interest has been shown in the small "502" shaft gas turbine that the Boeing Airplane Co. has been developing the past three years for industrial applications.

The present unit has a continuous output shaft rating of 160 hp with a 200 hp emergency rating.

The advantages this small unit has over any piston engine are its simplicity of design, light-weight, small volume, and its torque characteristics. Its present disadvantages are its high fuel consumption, low efficiency, and manufacturing cost. It still has to prove its reliability.

The next few years of research may undoubtedly overcome to a great extent most of the disadvantages enumerated.

At present a considerable percentage of the power goes to driving the turbine compressor. By improving the efficiency of the turbine compressor by cutting down this energy requirement, the turbine will give more available hp on the shaft.

An improvement can be made in the efficiency of the burner by raising the combustion temperature so that the heat that is developed can be fully utilized with as little as possible lost via the exhaust.

Practically all tests to date on this small turbine have been made using liquid fuels, but natural gas can readily be used with slight changes in the burner design.

The manufacturing cost of the present small turbine has been high because of the large amount of research work required, critical alloys used, and the lack of quantity construction. Costs should tumble rapidly when conditions are such that production can be made in large quantities.

Conclusions

At present the world position is that a few gas turbine power stations have already done a small amount of running, and a number of new stations are under construction and on order, but rapid progress is being made in further development.

The open cycle gas turbine has an advantage over other prime movers in compactness, low capital cost, and ease of control.

With present metallurgical limitations the simple open cycle with no allowance for auxiliaries can achieve a thermal efficiency of about 17 to 18 per cent, by adding heat exchange apparatus 25 to 30 per cent. By compounding, intercooling and reheating, the thermal efficiency and the specific weight can still be bettered but at much higher initial cost.

The high efficiency gas turbine plant, unlike the other prime mover systems, requires a design of close attention to details in all respects. Insistance on optimum design is necessary because:

(1) Operation is at temperatures approaching metallurgical limits.
(2) Flow rates of the working substance are large.
(3) The high "backwork" input to the compressors multiplies the cost of flow-friction power.
(4) Machinery arrangements must be compact.

Small cheap stand-by units of the

(Continued on page 44)

* See AMERICAN GAS JOURNAL, August 1949.

Central Control of Operations Started At Hunts Point Gas Plant

NATURAL GAS INTRODUCTION Into Consolidated Edison System POSES MIXING PROBLEMS

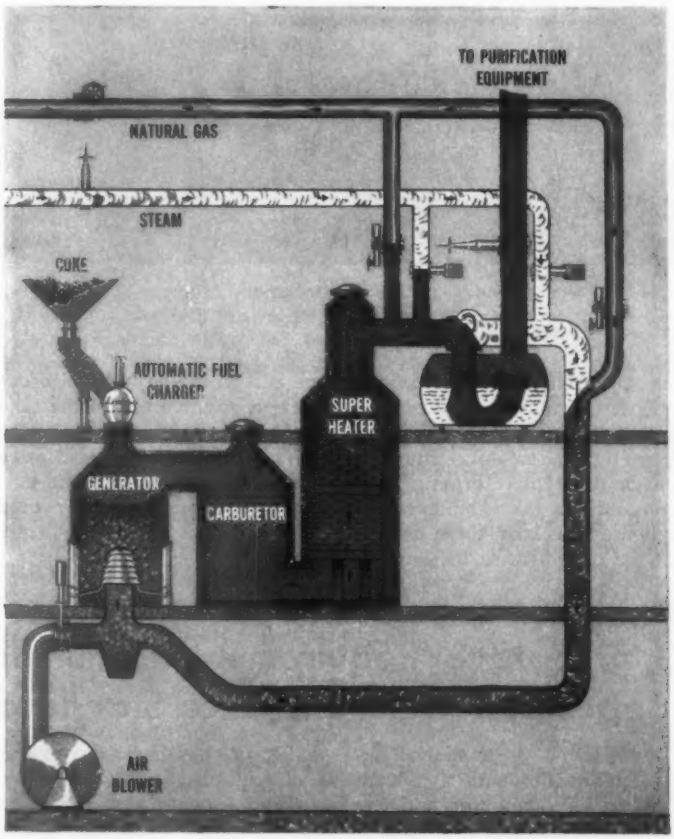


Illustration from annual report of Consolidated Edison Company of N. Y.

This is how natural gas is reformed in existing water gas manufacturing equipment. Steam and natural gas are passed through a bed of incandescent coke in the generator to produce a gas with relatively low heat content. After the gas is purified it is enriched with natural gas to bring the heat content up to the level required for distribution to customers. Formerly oil was used for enriching.

BEFORE the advent of natural gas, the gas made at the Hunts Point plant of Consolidated Edison Company of New York was a mixture of carburetted water gas, coke oven gas, producer gas and on peak days propane or butane air gas. The heating value of each of these gases (except producer gas) was normally maintained at 537 Btu.

With the use of natural gas, three additional gases were added to the plant production. These gases are a reformed natural gas of about 400 Btu made in the water gas plant, a jet gas which is a mixture of natural gas and air, and natural gas used for cold enrichment to bring the gas in the holder to 537 Btu. Because of the number of gases involved and because the final gas must be interchangeable with the gas formerly produced, it was necessary to have a centralized control of the plant operations.

Three Rooms

The control house is divided into three main rooms: the control room which contains the control board, a calorimeter room in which all the calorimeter tank units are installed and an appliance room which contains various gas appliances that are operated to check gas interchangeability.

On the control board are mounted all the instruments necessary for controlling the plant operation and the natural gas use in the plant. The arrangement of instruments on the board follows generally the gas flow through the plant. The left hand section registers the heating values and gravities of the plant gases and the necessary pressures for purifier exhauster operations. All the controls for the remote operation of the jet plant are installed on this section of the board. On the central portion of the board are mounted the recording equipment for the meters for the natural gas coming into the plant and for the submeters required for plant uses. On the right-hand section of the board are the storage holder inlet and outlet gas Btu and gravity recorders, holder height indicator, together with the automatic controls which add the proper amount of natural gas for cold enrichment. The gas pressures in the plant and the gas pumping pressures on the transfer mains leaving the plant complete this section of the board.

The operator has all the instruments needed to check and control the plant

A view of the control room at the Hunts Point plant in New York City.

mixing operations from the control room. Each day an allotment of natural gas is given to the plant. The natural gas allotment is broken down into the amounts to be used for reforming, cold enrichment and jet gas. The operator keeps a running check on these uses in order that the allotment is used up at the end of the day and in order also to prevent any overrun in the take of natural gas.

The quantity of natural gas available combined with the gas send-out requirements determine whether or not carburetted water gas should be made in the plant.

AGA Approval Requirements Committee Adopts New Gas Appliance Standards

IMPORTANT new gas appliance approval requirements and significant revisions of existing standards and test methods were adopted by the American Gas Association Approval Requirements Committee at its recent meeting at the AGA Laboratories in Cleveland. The Approval Requirements Committee is composed of representatives of utilities, manufacturers, public bodies and trade associations.

The committee reviewed and adopted the recommendations of a number of its subcommittees aimed at modifying individual requirement tests to meet new trends and industry needs as disclosed by research, technical investigations and field experience throughout the country. The new standards will go to the American Standards Association for final adoption and, upon acceptance, will become effective in 1952.

Major revisions adopted will affect the testing of central heating equipment, unit heaters, water heaters and automatic pilots. Of special importance was the adoption of new test methods covering electrical components on appliances and expansion of existing provisions for such features.

Central heating revisions cover the many changes in design that have accompanied the trend to compact, automatically controlled equipment, in many instances requiring advanced electrical and mechanical components. Revisions also apply to units designed for confined space installation and recessed heaters.

Electrical requirements for central heating appliances, unit heaters and ranges have been coordinated with those of other testing organizations. In order that greater acceptance of appliances by electrical code authorities may be obtained, the AGA Laboratories have installed new electrical testing facilities and will formulate test methods covering all types of appliances.

Listing requirements for automatic pilots were completely rewritten to provide for their testing under conditions more nearly approaching those encountered in the field.

Revisions to water heater requirements included standards for a new high temperature classification for automatic storage type heaters covering units intended to deliver outlet water at a temperature in excess of 160 degrees. Modern demands for commercial units for sterilizing dishes and tableware, as well as domestic hot water needs for automatic dishwashing and clothes washing, in many instances call for water up to 180 degrees in temperature. Such units now must meet all requirements for ordinary automatic storage type heaters and also meet additional tests established for such special classification. Testing of such units is optional and will only be conducted on request.

Thermostatic control of gas range ovens was made a mandatory requirement to be effective immediately. The move has been desired for some time by the majority of utility companies as a necessary step in upgrading the quality of gas ranges. It also had the full support of the domestic gas range division of the Gas Appliance Manufacturers Association and the gas range section of the Pacific Coast Gas Association.

El Paso Files 3 Applications To Expand Capacity

El Paso Natural Gas Co. has filed three separate applications in lieu of an earlier single request for Federal Power Commission authorization to expand the capacity of its natural gas transmission system in Arizona, New Mexico, and Texas by 400 million cu. ft. per day.

The first application proposes the construction of facilities which would be used to make available an additional 100 million cu. ft. of gas daily to present customers on the El Paso system in Arizona, New Mexico, and Texas. This construction program is estimated to cost $23,250,000.

The second of El Paso's new applications is for authority to build facilities designed to make available an additional 200 million cu. ft. of gas per day jointly to Southern California Gas Co., Southern Counties Gas Co., and Pacific Gas and Electric Co. Estimated cost of this project is $51,720,000.

The third application involves a proposed $16,970,000 construction program and proposes delivery of an additional 100 million cu. ft. of gas per day to Pacific Gas and Electric Co.

39-Mile Pipe Line Proposed By New York State Natural

New York State Natural Gas Corp., of New York City, has asked the Federal Power Commission for authority to construct a 39-mile pipe line in Pennsylvania and New York to help meet increasing demands of present customers.

The proposed 20-inch line, estimated to cost $2,093,700, would extend from the company's state line compressing station in Potter County, Pa., to the boundary line between Livingston and Monroe Counties, N. Y.

Natural Gas Essential to Northwest For Defense and Power Programs

by Charles H. Gueffroy

President, Portland Gas & Coke Co., Portland, Ore.

THERE are two immediately important elements of the natural gas problem in the Pacific Northwest: First, an adequate supply of natural gas is greatly needed for the defense program; second, an available supply of natural gas will be complementary to the future development of the market for electric power.

Natural gas is being substituted more and more for the manufactured product until today 90 per cent of the gas industry represents natural gas operations. The Pacific Northwest is now the only large region in the United States without a supply of natural gas definitely scheduled.

The United States Munitions Board recently surveyed conditions in the Pacific Northwest, and came to the conclusion that a supply of natural gas to this area is essential to the defense effort, and addressed a communication to that effect to Charles E. Wilson, Defense Mobilizer. Mr. Wilson is reported to have referred the problem to the Secretary of the Interior for his recommendation.

Why Now?

Secretary Chapman is also Petroleum Administrator for Defense, and in that capacity has jurisdiction over all defense matters pertaining to both petroleum and natural gas. Mr. Chapman's attention is being directed to authentic data and reasons showing that the importation of natural gas into the Pacific Northwest should be undertaken without delay. Because of the size and complexity of the oil and gas industries, a difficult task faces defense mobilization officials in controlling the allotment of steel so as to obtain its best use for the over-all program.

What is the relation between natural gas for the Pacific Northwest and the requirements of national defense? Since we came successfully through two wars without that resource, why is it important now? The answer is obvious to us who live here and have observed our great growth in population and industrial development. Our experience shows that the defense effort will greatly increase industrial demands for all forms of energy.

The Pacific Northwest, including the Province of British Columbia, is the second fastest growing area in North America. In 1940, before World War II, the combined population of Oregon and Washington was 2,825,875. The unofficial figure is now 3,875,389, with an increase of 38.8 per cent in Oregon and 36.1 per cent in Washington. From 1941 to 1949 the population increase in the Province of British Columbia was 41 per cent.

Many Defense Industries

Approximately one-half of the present national production of aluminum comes from reduction plants in the Pacific Northwest. Other industries here essential to defense include atomic energy plants, calcium carbide, silicon carbide, ferro alloys, magnesium, shipping, lumber and allied plants, and shipbuilding and repair. Electric power is of course the prime mover of them all. We also have an important naval base at Bremerton, where the largest naval vessels can be repaired. We have many other industries essential to civilian life and to the public health and well-being.

The principal fuel used by industries and the people of this area is oil, as no anthracite coal is produced and the bituminous coal production is not large. Oregon and Washington alone, with only 2.5 per cent of the nation's population, used five per cent of the total national consumption of residual fuel oil and 5.3 per cent of the distillate oil in 1949. Portland Gas & Coke Co. itself uses for gas manufacturing more than one-fifth of the total amount of residual oil consumed in the state of Oregon.

At this time, practically all oil consumed in the Pacific Northwest must be brought in from California by tanker. This region was compelled to adjust itself to restricted deliveries during World War II, because of the voracious demands of the Navy and the war industries, and because tanker deliveries were slowed down materially by the use of convoys after several tankers had been sunk by enemy submarines. The practice of convoying tankers had to be abandoned, when it was found that oil requirements of the region could not be supplied under such restrictions.

It is clear that the whole economy of this area would be disrupted, and most of our defense production would come to a full stop, if the supply of fuel oil were cut off by interference with tanker shipments. It would be even more serious for the manufactured gas industry in Portland and Seattle, where service to 150,000 customers could not be restored for many days.

I am sorry not to have the data for a comparison of 1940 and 1950 oil consumption in Oregon and Washington, but it would show a tremendous increase. In 1946 the total distillate and fuel oil consumed in these two states was 39,805,000 barrels, and by 1949 the amount had grown to 42,446,000 barrels. The increase in distillate or diesel consumption has been even more significant, from 12,287,000 barrels in 1946 to 17,558,000 in 1949, an increase of 43 per cent. Distillate oil is a very critical product in war time. These figures show how great is our dependency upon oil, and upon the uncertainties of ocean shipments along a relatively unprotected coast.

12 Million Barrel Saving

According to market surveys made by the principal gas distributing companies in the Pacific Northwest, an adequate supply of natural gas in a few years would save the use of approximately 12,000,000 barrels of oil per annum now consumed in this region. To make possible such a saving of this valuable resource would constitute an outstanding contribution to the future of our national security. Today petroleum people are planning an oil line from Texas

Presented at meeting of Bonneville Regional Advisory Council, Portland, Mar. 16, 1951.

to California, and I believe the availability of natural gas in this region would go a long way toward eliminating occasion for such a line, particularly since a crude oil pipe line is also being projected from Alberta to Vancouver and possibly to some point in Washington or Oregon. While such an oil line from Alberta would save California oil, it could not possibly be a substitute for a natural gas line from the standpoint of national defense, as distribution of petroleum products would still have to be made from the refinery locations. What is required in the Pacific Northwest is an alternate fuel distributed below ground, instead of by tanker or rail.

It is recognized that a power shortage exists in this region which will not be relieved for several years, and that a critical water year would mean burning several million barrels of oil in steam power plants, which would necessitate the use on the Pacific Coast of more tankers than now operate in this area. Natural gas would dispose of this problem, as for the first few years the pipe line would have a capacity in excess of immediate markets, and gas could be used for fuel in such steam plants for at least a portion of the year. I can't tell you how many thousand kilowatts of electric power or million kilowatt hours of electric energy would be conserved by the availability of natural gas, but I know it would run into large figures. The prevailing low electric rates in the area are a constant temptation to customers to use electric energy for space heating, a demand which would be accelerated by the necessary limitations on the consumption of manufactured gas for space heating, and eventually by restrictions on automatic heating by oil.

I understand that at the Hanford atomic energy plant there is an electric space heating demand of 15,000 kilowatts which certainly could be replaced by natural gas. Our company's rate engineer estimates that in the region served by the Pacific Northwest Power Pool a one degree drop in winter temperature will immediately increase the combined demand of electric space heating customers by 12,000 kw, a type of business having an annual load factor less than 25 per cent, and consequently not conducive to efficient utilization of critical electric capacity. As natural gas rates would be much lower than rates for manufactured gas, there is little question that the demands for electric energy for space heating would be immediately reduced to the mutual benefit of customers and the regional economy.

The second point is that natural gas would be complementary to the expansion of our electric power resources. There is no room for argument on this score. Bernard Goldhammer, economist of the Bonneville Power Administration, covered the subject thoroughly and with conviction. He said:

> "Industry in general requires energy for heat and steam, for mechanical power in driving motors, and for electricity in electrolytic and chemical processes. If we can use natural gas for thermal energy, we will be able to move more of the electric energy up a step on the technological ladder and use it in chemical processes. In this manner we will secure the highest possible use of our resources."

We have, in the Pacific Northwest, most of the natural resources that industry needs. We have an abundance of water and will have, in due course, an adequate power supply. What we lack more than anything else is a supply of cheap Btu's.

What we estimate will happen to the business of my company when natural gas becomes available is shown by the following comparison. In the year 1950, our gas sales were divided into the following classifications:

Residential cooking, water heating and refrigeration	36%
Commercial and industrial	18%
All types of space heating	46%
	100%

We estimate that at the end of the first five-year period of natural gas operation, the percentage of total sales for residential use will be 11 per cent, for commercial and industrial uses 57 per cent, and for total space heating 32 per cent. Note particularly the estimated growth in commercial and industrial sales from 18 per cent of the total now to 57 per cent, and the estimated decrease in the percentage of total sales

(Continued on page 40)

E. HOLLEY POE DIES

E. Holley Poe

E. Holley Poe, prominent figure in the gas industry, died suddenly Friday, March 9, at Tulsa, Oklahoma. He resided at Stamford, Conn., and maintained offices at 70 Pine Street, New York City.

Mr. Poe was President and treasurer of AMERICAN GAS JOURNAL, one of the oldest business periodicals in the country.

Mr. Poe formed the Texas Eastern Transmission Corp., which purchased the big and little inch pipe lines from the government, and was its first President. This company converted the pipe lines from oil to natural gas, and was first to deliver natural gas to New York City when, in August 1949, it started to serve the New York & Richmond Gas Co. on Staten Island.

Mr. Poe was born in Pawnee, Oklahoma, on September 14, 1894. His father was the late Judge L. M. Poe, early Indian Territory jurist.

Mr. Poe worked for several newspapers and oil companies in Oklahoma, and from 1926 to 1936 was manager of the Oklahoma properties of the Central States Power and Light Corp.

In 1937 he came to New York as secretary of the natural gas department of the American Gas Association. During World War II he was director of the Natural Gas and Natural Gasoline Division of the Petroleum Administration for War.

He was also executive vice-president of the Petroleum Reserves Corporation under the Department of the Interior.

In 1944 Mr. Poe formed a consulting firm, E. Holley Poe and Associates, with offices in New York, Washington, and Chicago.

He was also a director of Texas Eastern Transmission Corp., vice-president and director of Atlantic Venezuela Transmission Corp., vice-president and treasurer of United States Pipe Line Co., chairman of the board of the Venezuela Research and Development Corp., chairman of the board of North American Petroleum Gas Corp., director of New Brunswick Oilfields, Ltd., and President of Northeast Utilities Equipment Corp., of Stamford, Conn.

Mr. Poe was also a partner in Edward W. Ackley and Co., an investment brokerage firm in Boston, Mass.

Survivors are: Two sons—Robert M. Poe and Richard H. Poe, of Stamford, Conn.

One sister—Myrtle Poe, of Tulsa, Oklahoma.

Four brothers—John H. Poe and Roy R. Poe, of Tulsa; Lane Poe, of Oklahoma City; and Lewis M. Poe, of Colorado Springs, Colorado.

Underground Storage Columbia Solution To Seasonal Peak Problem

by Stuart M. Crocker

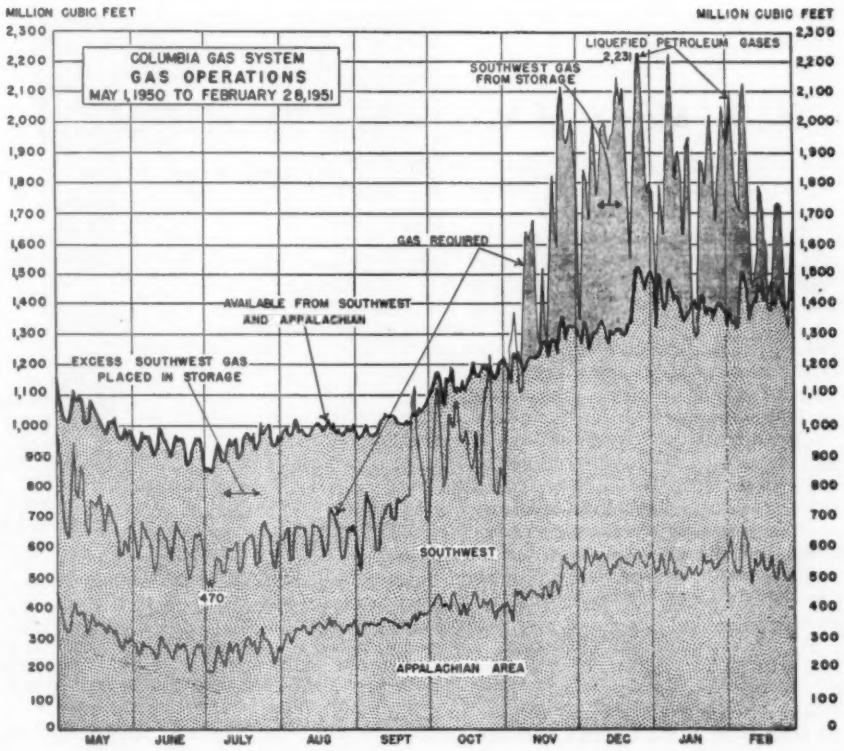
President, The Columbia Gas System, Inc., New York

THE introduction of southwest gas into the Appalachian area and the considerable increase in the seasonal use of gas for house heating have created many problems.

The long distance southwest pipe lines cannot be operated economically on a seasonal basis. They must be operated at near capacity the year round. Southwest gas would cost us too much unless we purchased it in substantially the same daily quantities year in and year out. Yet the daily demands for gas made upon our system vary tremendously. For example in 1950 the average daily send-out of our system was 1 billion, 33 million cu. ft. although it varied from a low of 470 million cu. ft. to a high of 2 billion, 231 million cu. ft. The principal reason for this variation in demand is the house heating load. The more house heating connected to our system, the more acute our dispatching problem becomes. Now, various methods are being used to solve this problem of poor load factor resulting from the seasonal character of the business. In some parts of the country companies are resorting to the sale of gas during the summer months for boiler use. Fortunately in the Appalachian area this method, which I think should be avoided where possible, is not generally used. The development of underground storage of gas in Appalachian gas fields has been the perfect solution.

To illustrate the importance of underground gas storage and the problem inherent with seasonal house heating business, refer to the operating chart which covers the period of May 1, 1950 to February 28, 1951.

We are taking gas from our southwest suppliers at practically 100 per cent load factor. Where possible, we are drawing upon our own 10,000 Appalachian wells for winter use only. This specialized use gives them an exceptionally high rate of deliverability. Keeping those facts in mind, take a look at the chart. It shows gas available and gas sendout. Note how during the summer months we met part of our requirements with Appalachian gas and required only a part of our southwest gas for current demands. The balance of the southwest gas we were able to place in underground storage. Now look across the chart and see what happened in the winter months. Beginning in late September, heating was required and the daily sendout jumped materially. Even then, except for one short period, sufficient Appalachian and southwest gas was available for current requirements. Going into October, we were still able to continue to place gas in storage. But now as we go into November and encounter real heating weather, the picture changes. Here the total gas available from the Appalachian area and the southwest was far short of the amount required and substantial amounts were taken from storage.



This is a small portion of a complete and comprehensive paper entitled, "Natural Gas Comes of Age," which Mr. Crocker read at the meeting of the division of production of American Petroleum Institute, at Columbus, Ohio, Apr. 4.

You will notice that in winter, the sendout varied substantially from day to day. These wide variations could not have been handled were it not for the fact that storage took up the impact of changing demands. Southwest and Appalachian gas continued to flow normally into the transmission system and as demands varied we increased or decreased our withdrawals from storage.

During this past winter we have taken as much as 850 million cu. ft. of gas from storage in a single day. Now, if we

had to build southwest pipe line facilities with this daily capacity, it would cost several hundred million dollars. By comparison the cost of our underground facilities amounted to only 35 million dollars. This includes also the cost of the gas cushion. That is the purchased gas placed in storage to create the pressure needed to obtain a high rate of deliverability from the storage wells.

Producers in the Appalachian area may wonder what southwest gas and its storage mean to them. In my opinion there was never a time when Appalachian gas was more needed than at present. I do not say this because of the present shortage of natural gas in the area. I am thinking of the long-range picture. I believe that Appalachian gas can be of increasing importance especially when its producers will sell on a seasonal basis. Where we can obtain Appalachian gas with a high rate of deliverability, we would prefer to conserve it for seasonal or peak requirements. As I have said, we are doing this with our own production wherever possible and in a few cases we have worked out arrangements with independent producers to purchase their gas on a strictly seasonal basis. Such arrangements must, of course, recognize the problems of the independent producer, and gas purchased for winter delivery only should command a higher price.

Study Made of Wage and Benefit Policies of 17 Gas Utility Companies

The US Department of Labor, Bureau of Labor Statistics, has recently made a survey of wage and related practices of gas utilities. This study was limited to all privately operated gas utility companies and gas divisions of privately operated electric utility companies serving cities of 75,000 or more population in six Great Lakes states.

The number of workers and the wage data refer to the gas operations in 27 cities of more than 75,000 population served by the 17 companies studied.

Of the 11,261 plant workers in the Great Lakes area, 11,108 are men and 153 are women. The average straight-time hourly wage is $1.56; men: $1.57, women: $1.02.

Wages for drip pumpers range from $1.35 to $1.75. Two receive the lowest hourly wage and four receive the highest. The average wage for the 32 drip pumpers employed in the Great Lakes area is $1.55 per hour.

Some 103 gas makers work for an average wage of $1.81. Wages range from one man earning $1.55-$1.60 to 29 men earning $1.90-$1.95 per hour each.

Wages for gas plant laborers are from 14 men receiving $1.25 to 20 men receiving $1.70. The average wage of the 321 gas plant laborers is $1.47.

A total of 657 meter readers are employed and have an average wage of $1.54 per hour. Six men earn the lowest wage of $.95, while one man earns the highest of $2.70 and over.

The average wage for the 31 pipe fitters is $1.78. Three earn $1.35 per hour, while 13 earn $1.95.

All the workers were paid time rates except 118 meter readers, 22 appliance service men, and 14 truck drivers who were paid incentive rates.

The scheduled number of weekly hours for every worker in the Great Lakes area is 40. All workers receive paid holidays.

All the privately operated gas utilities in the Great Lakes states have insurance or pension plans as the following table shows:

INSURANCE AND PENSION PLANS

	Per Cent of Total Employment	
	Plant	Office
All workers	100.0	100.0
Workers in establishments having		
Insurance or pension plans	100.0	100.0
Life insurance	100.0	100.0
Accidental death and dismemberment	1.2	2.3
Accident and sickness	13.1	16.7
Disability pension	11.0	12.8
Retirement pension	100.0	100.0
Hospitalization	75.7	72.8
Medical	37.8	32.3
Surgical	75.7	72.8

Vacation policies are shown by the following table:

VACATION POLICIES

	Per Cent of Total Employment	
	Plant	Office
All workers	100.0	100.0
After 1 year of service		
Workers in establishments having paid vacations	100.0	100.0
1 week	43.5	37.2
2 weeks	56.5	59.0
3 weeks	—	3.8
After 2 years of service		
Workers in establishments having paid vacation	100.0	100.0
1 week	9.5	12.5
2 weeks	90.5	83.7
3 weeks	—	3.8
After 5 years of service		
Workers in establishments having paid vacations	100.0	100.0
1 week	—	—
2 weeks	100.0	96.2
3 weeks	—	3.8

Natural Gas Dep't Meets In Dallas, May 7-8

More than 1,000 delegates are expected at the 1951 spring meeting of the American Gas Association's Natural Gas Department to be held in Dallas on May 7-8, according to Elmer F. Schmidt, Lone Star Gas Co., vice-president and chairman of the meeting program committee. Sessions will be held at the Baker Hotel and presiding will be Charles E. Bennett, vice-president of the AGA and chairman of its Natural Gas Department. Mr. Bennett is President of the Manufacturers Light and Heat Co., Pittsburgh, Pa.

Key-note of the meeting will be "Economy of Natural Gas in National Defense Mobilization." Top speaker on this subject will be Bruce K. Brown of Washington, D. C., deputy administrator of the Petroleum Administration for Defense. Speaking on behalf of all segments of the gas industry will be D. A. Hulcy, of Dallas, Lone Star Gas Co. President, who is President of the American Gas Association.

As chairman of the AGA technical and research committee, Program Chairman Schmidt will present an interim report on the research program of the natural gas industry. Others to address the sessions include Paul Kayser, President of the El Paso Natural Gas Co.; Frank Lerch, of New York, President of Consolidated Natural Gas Co.; Olin Culberson, chairman of the Railroad Commission of Texas, and John E. Goble of Pittsburgh, Pa., President of the National Tube Co. James S. Moulton, vice-president of the Pacific Gas and Electric Co., San Francisco, will present a color-sound movie showing construction of the 500-mile, 34-inch natural gas transmission line from Toprock, at the Arizona-California border, to Miltipas on San Francisco Bay. The mayor of Dallas will welcome the delegates.

On Wednesday, May 9, the executive board representing the combined natural gas and manufactured gas departments of the American Gas Association will meet in Dallas for the "first session ever to be held in this section of the country."

Pittsfield to Drop Rates 10% When Natural Gas Arrives

The Pittsfield Gas Co., Pittsfield, Mass., has announced that a 10 per cent rate cut will be made when natural gas becomes available later this year.

Frank A. Woodhead, President, said the Northeastern Gas Transmission Corp., which will supply the Berkshire county area, had assured him natural gas will be available in that section by July. Mr. Woodhead said the 10 per cent reduction would be effective immediately upon completion of the gas line to Pittsfield.

Further reductions, he said, will be made when the cost of converting equipment has been written off the books.

Radiant Gas Heat Improves Technics Of Glass Manufacture

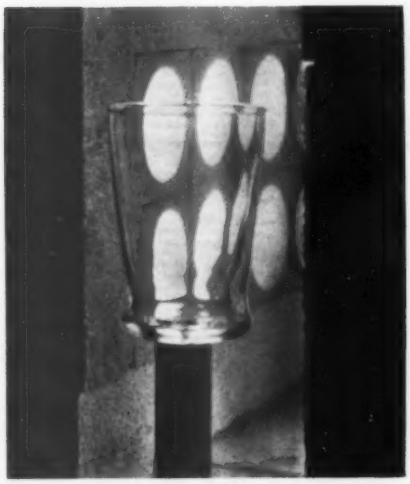
by Robert C. LeMay

Selas Corporation of America, Philadelphia

THE glass industry's increasing use of radiant gas heating has been responsible for additional gains in shortening heating cycles and improving product quality. Advantages of this relatively new working tool include production increases, fuel savings, reduction in equipment size and decreased loss of ware.

Throughout all industry, heating engineers have attempted to reduce fuel requirements, time cycles and equipment sizes toward theoretical minimum. In many fields this effort has been notably successful. The old rule of thumb that steel to be hardened should be heated one hour per inch of thickness has been discarded almost everywhere, and the same material is now heated for forging in minutes. High speed ink drying now permits fine quality four color printing on coated paper, in a single pass through the presses. New enamels are now completely baked in one-tenth the former time. Tubular heaters and steam boilers are built to only a fraction of their former sizes.

In contrast to the foregoing accomplishments, much heating equipment in the glass industry has remained bulky, time cycles are generally long and fuel requirements usually high. Theoretical glass annealing cycles can be computed from accepted formulas, but often are shorter than commercial annealing cycles by ratios greater than one to ten. When commercial cycles are long, equipment size and fuel requirments usually must be proportionately large. Figure 1 shows theoretical and actual heating time requirements for two types of glass, and figure 2 shows comparative time-temperature curves for one of these types. Both have been taken from H. K. Richardson's paper before the American Ceramic Society, as published in their *Bulletin* of January 15, 1950.



A water tumbler entering a typical radiant drier.

In fairness to the glass industry, it must be realized that their materials are difficult to heat. Common glass is a relatively poor heat conductor and is quite susceptible to breakage from uneven thermal stresses. Always a major problem, loss from this cause is one form of "shrinkage"—an industry term meaning loss of ware during production, from whatever reason. It is the attempt to minimize "shrinkage" that has always been responsible for prolonged heat treating cycles. These long cycles and small temperature differentials have served a purpose in minimizing strains within the ware.

During recent years forced convection has been popular as a uniform heating method, employing relatively low thermal differentials and high rates of air flow, well distributed. Most glassware, however, has *non-uniform* heat requirements. For example, to bring a heavy section and a thin section to the same temperature requires more heat for the heavier part. If typical convection heating is used, the thin section rises in temperature faster than the heavy section. The differential thermal expansion which results creates additional strain in the ware. This, of course, increases both liklihood of "shrinkage" and the burden on annealing equipment. Eventual uniform temperatures must be obtained by prolonged "soaking" at heat.

The alternative method is what might be called *proportional*, or *pattern heating*. In this method, heat is transferred in a manner which permits each section of the ware to receive it at a rate more nearly proportional to its particular requirement. Where this is successful, fewer strains are developed, and all parts of the ware reach the same temperature more quickly.

To recognize and accomplish this objective required a new approach to heating glass, and obviously a new heating method was also necessary. For the requirements of proportional heating, the radiant gas burner is well suited. Patterned arrangements of these burners permit heat sources to be matched with heat requirements. Radiant energy has the highest transfer rates and is free from the retarding effects of transparent surface films. Of particular significance is the fact that these burners release part of their heat within the glass itself, as will be explained later.

Many types of radiant gas burners are in use today. Although luminous flame and certain "atmospheric" burners can also be classed as radiant, this discussion will be limited to those whose radiant energy is developed by forcing carefully proportioned and compacted gas-air mixtures along refractory surfaces, where combustion heats those surfaces to incandescence. These burners are available in many styles and capacities and may be used in the open or built into heating panels or furnace brickwork.

Ceramic materials used in radiant burners are numerous, and should be

Presented at AGA Industrial and Commercial Sales Conference, Washington, D. C., April 2-4, 1951.

OPERATION	LOW EXPANSION (BOROSILICATE) 3/8 INCH THICK		LIME GLASS - (90 x 10^{-7} COEF.) 1/10 INCH THICK	
	THEORETICAL	COMMERCIAL	THEORETICAL	COMMERCIAL
PREHEAT FROM INITIAL CONDITION TO TEMPERATURE LOG 13.0	1.0	41.0	0.5	2.0
SOAK AT LOG TEMPERATURE 13.0 (INSTANTANEOUS ANNEALING POINT)	2.0		0.5	
ANNEAL THROUGH CRITICAL RANGE LOG 13.0 TO STRAIN POINT	10.0	29.0	0.6	10.0
COOLING FROM STRAIN POINT TO HANDLING TEMPERATURE	9.0	170.0	0.4	20.0
TOTAL	22.0	240.0	2.0	32.0

Fig. 1 Comparison of annealing cycles in minutes. Theoretical vs commercial of glasses shown.

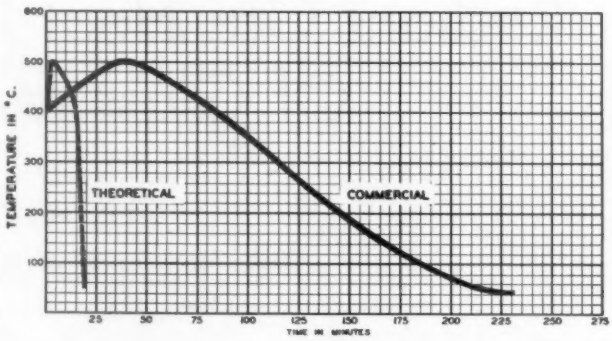


Fig. 2 Graphic comparison of annealing cycles. Theoretical vs commercial for low expansion. Borosilicate glass 3/8 inch thick.

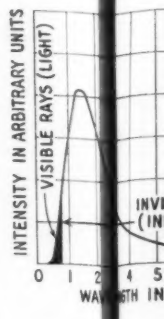


Fig. 3 R... ene... typ... adiant

selected for the particular application to give the best combination of high radiant emission, long life, low heat storage and low thermal conductivity. Where high temperatures will be experienced, the usual metal parts can be replaced by alloy or all-ceramic construction. Because of the small diameter or width of individual ports, and flame retaining qualities of hot refractories, most radiant burners possess wide turndown qualities.

Accurate gas-air ratio control is important because excess of either gas or air will reduce burner temperature. Furthermore, combustion equipment for the previously described "pattern heating" should be such as to permit turning individual burners down or entirely off without affecting gas-air ratio in other burners. In this way proper pattern adjustment can be made to suit the work being heated.

Radiant and Convected Heat

Radiant burners convert incoming fuel gas energy to useful radiant and convected heat. In addition—as in all gas burners—there is unavailable heat, better known as flue loss. We should think of the radiant burner as a source of all three. One difference from other burners, however, is that in these burners radiant heat accounts for an important part of the total. In well designed glass heating operations, radiant energy is of course first utilized as effectively as possible and then the hot burned gases are employed for additional transfer by convection—frequently for preheating.

Radiant Heat and the Electromagnetic Spectrum

The successful use of radiant heat in the glass industry requires rather careful consideration of the electromagnetic spectrum, which contains in their proper relative positions all of the waves which transfer energy. These of course include light and heat rays, X-rays, radio and sound waves, and all the rest. Those in the range in which we are now interested are measured in microns—a micron being one millionth of a meter.

Figure 3 covers that portion of the electromagnetic spectrum where wave lengths are less than 10 microns. On it is shown a curve indicating the distribution of radiant energy from a typical radiant burner, with maximum emission at this particular temperature at 1.4 microns. The visible light band is the shaded section between .4 and .7 microns, and it is readily seen that most of the burner's energy is invisible, or infrared. Infrared, of course, is merely a name assigned to heat rays as a group. It is not a trade name registered by the electric industry. Included in the group are all heat rays, whether they come from the sun, an incandescent lamp, a radiant gas burner or a parlor steam radiator. They vary, however, in intensity, and in distribution of wave lengths.

Radiant heat rays both change in intensity and redistribute themselves with changes in source temperature. As temperature rises, total radiation increases and shorter wave lengths become those of greatest intensity. As temperature drops, these changes are reversed. This is significant in heating glass, in which reception of radiant heat changes with the wave lengths.

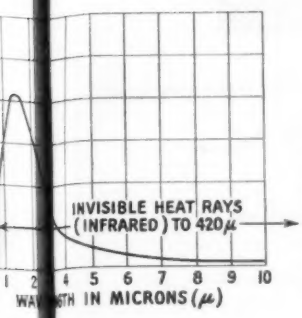
Glass Reflects, Transmits, Absorbs

It has often been implied that heat from radiant burners has mysterious penetrating quality in the heating of metals and other opaque materials. So far as we know, however, heat which reaches the interior of a piece of gas-heated metal arrives there by conduction from the surface. In the heating of glass, however, a different situation exists. We are dealing with a decidedly different group of substances and they must be treated as such.

Properties of glasses vary widely, for there are hundreds of formulas in commercial use today. Some, for example, have high dielectric strength while others readily conduct electricity. Likewise, the reception of radiant heat by glasses varies widely also. Radiant energy may be reflected, transmitted or absorbed. In the radiant heating of most glass, all three occur together.

Figure 4 shows transmission by three different types of glasses of comparable thicknesses but with different analyses, using wave lengths from 0 to 3 microns. Obviously, where transmission is low, absorption is high. Curve A is for a high clarity glass which passes at least 90 per cent of light rays and most of the infrared up to about 2.6 microns. Curve B is another glass which transmits many of the light rays but absorbs and converts most of the infrared rays into heat. Curve C, on the other hand, transmits no visible light but passes most infrared rays up to 2.6 microns.

Figure 5 shows these same glass transmission curves plotted with that segment of the radiant burner emission curve which lies in the same range—from 0 to 3 microns. By comparison it can be seen that most radiant heat absorption by glasses A and C take place beyond 2.6 microns where radiant burner output is not so great. Glass B, however, readily absorbs those heat rays which the burners deliver in greatest quantity. The conclusion reached, of course, is that in the radiant heating of glass, the matter of



3 R… energy delivered by typ… diant gas burner.

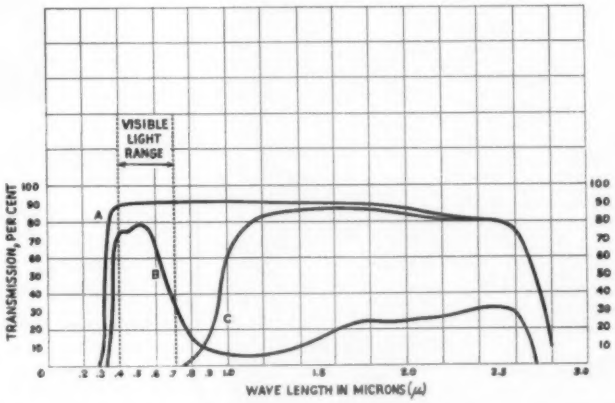


Fig. 4 Radiant energy transmission through three types of glass. Samples 5.8 to 7.1 mm. Data from Pittsburgh Plate Glass Co.

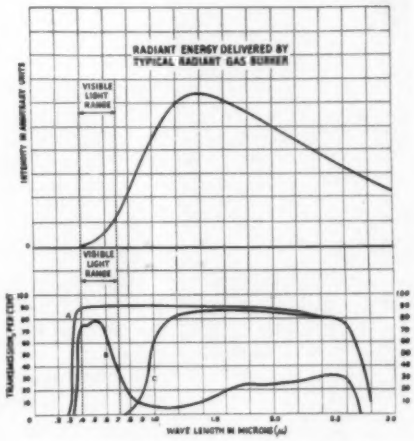


Fig. 5 Radiant energy transmission through three types of glass. Samples 5.8 to 7.1 mm. Pittsburgh Plate Glass.

wave lengths deserves careful consideration.

Advantages of Radiant Heating

It has already been pointed out that infrared energy comprises only a portion of the output of a radiant gas burner. On-the-job performance, however, has shown that the importance of this radiant energy portion is much greater than is indicated by quantity alone.

Higher Rates of Heat Transfer

It is well known that radiant energy travels in straight lines at a speed of 186,000 miles per second. Speed is not the only consideration, however, because operating temperatures, thermal differentials and other factors play important roles in determining rates of heat transfer. To provide graphic comparison of transfer rates developed through radiation, forced convection and natural convection methods, figure 6 has been taken from data compiled at the University of Leeds in England. Curves A and B encompass all of the radiant heat transfer rates from sources with ordinary emissivities. Emissivity is radiating efficiency as compared to that of a "black body" or perfect radiator under the same conditions. Curves C and D indicate convection transfer rates with velocities of 50 and 30 feet/second respectively. Curve E gives comparable data for natural convection.

It will be noted that when temperature difference between heat source and work exceeds approximately 1000°F, heat is transferred by radiation much more rapidly than by other methods. Operating temperature differentials between glass and radiant burner surfaces are well in excess of this figure.

Independence from Transfer Agents

All convection heat transfer is retarded by the effect of the so-called "dead film." This is an insulating layer of gas or liquid which adheres tightly to solid surfaces and tends to prevent direct contact between heat transfer media (such as heated air, oil or water) and the solid surface. These films, which will retard heat flow on both sides of the wall, can, of course, be made less effective by increasing flow rates.

Radiant heat waves travel uninhibited through transparent surface films, are not affected by them, and do not require fast moving transfer media.

Transmission and Absorption in Glass

As has already been shown in figure 4, radiant energy is both transmitted and absorbed by glass, in proportions which depend upon wave lengths, glass composition and glass thickness. Because most glasses are poor heat conductors, any heat released within glass materially reduces the time which would be required for it to creep inward by conduction. Simultaneous external and internal heating also reduces temperature differentials which are usually a major cause of glass "shrinkage."

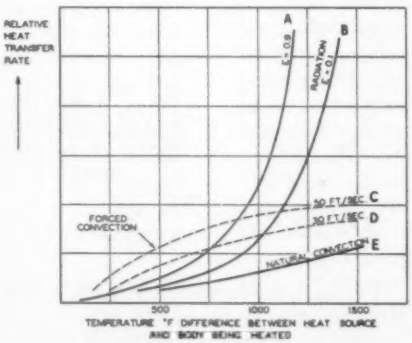


Fig. 6 Temperature °F difference between heat source and body being heated.

Availability of Patterned Heat

Directional control over radiant energy makes it possible to transfer heat in patterns that are matched to work requirements. With radiant gas burners, these patterns are both versatile and adjustable. Except where direct and sharp flame contact with the ware may be tolerated, this is not readily accomplished with other burner types.

Outstanding Production Applications

To meet exacting production requirements, specific radiant heat applications have been worked out by glass producers. Calling upon knowledge gained in glass and other industries, numerous radiant heat processes have also been developed by the equipment manufacturer. Further contributions have been made by the industrial gas engineer. Some of these applications have resulted from what might be called thorough analytical studies of basic heating requirements, while others were worked out in sheer desperation after all other methods had failed.

New radiant gas heat applications continue to appear, and some of these are so far afield from long accepted conventional practice as to arouse some quite understandable skepticism. Although customer reticence prevents discussion of some of the more interesting uses, enough significant applications may be mentioned at this time to indicate the further possibilities of radiant heat in the glass industry.

Shown here are picture tubes on a large dial machine where the sealing operation is being performed. Small radiant burners are at the left and right of the operator, just below shoulder level.

Fluorescent Lamp Tube Lehrs

Flourescent lamp tubes are made in a number of lengths and diameters, but all of them must be heated for baking the interior coating, for straightening and for annealing. Much of this production is carried out in remarkably short, high speed lehrs. At rates approximating one tube per second, these three operations all take place beneath radiant roofs in "heating machines." Similar lehrs, which permit easy arrangement of radiant roof patterns from operating floor levels, are in use today from Manila to Madrid. In this application, some radiant energy passes through the glass to bake flourescent coatings from within. Simultaneous external and internal heating shortens cycles, reduces both equipment size and fuel requirements.

Baking Monograms on Lamps

On the top of each incandescent lamp is a small monogram which gives the maker's name and lamp rating. That monogram is fired in what amounts to a local or "spot" heating job. A small round radiant burner permits fast heating at close range, and yet without flame impingement. The reduced transparency of the imprint permits it to absorb radiant heat faster than the glass around it. This method has increased both speed and quality of production. As a result, a leading lamp producer has recently instructed all plants to convert to it.

Tempering Faces of Metal TV Picture Tubes

Where preformed glass picture tube faces are fused to metal tube side walls, it is necessary to temper these faces and redistribute strain patterns within the glass in such a manner as to reduce the likelihood of subsequent breakage. This was formerly done by sweeping the face with bushy gas flames while oxy-gas torches fused the glass-to-metal seal at the edges. It has recently been found, however, that radiant burners placed above and directed down toward the faces succeed in producing much improved strain distribution. This probably results largely from the fact that internal strains respond to patterned heat released within the glass.

Sealing "Guns" in Picture Tubes

Probably the earliest application of radiant gas heat in picture tube manufacture was where so-called electron "guns" are sealed into the narrow tube necks. The electronic mechanism is previously mounted on a glass stem assembly, with a flange slightly smaller in diameter than the glass tube neck. Although the actual seal and cut-off is usually performed by oxy-hydrogen flames, both preheating and annealing is accomplished with air-gas burners. Originally bushy flames were employed here, but small non-impinging radiant burners were found to be so satisfactory that they are now almost universally used for the purpose.

Baking Out TV Picture Tubes

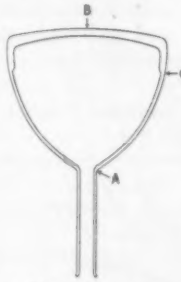


Fig. 7 Cross section of typical all-glass TV picture tube.

Figure 7 shows the cross section of a large all-glass picture tube. A phosphor coating is applied on the inside of the face B and a conductive "Aquadag" coating on the tapered inside walls A

(Continued on page 42)

American Gas Fundamentals

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Natural Gas
1. Geology
2. Drilling and Production

Manufactured Gases
1. Coke oven gas; producer gas, blue gas; carbureted water gas
2. Reformed gas
3. Hi-Btu oil gas

Transmission
1. Pipe lines
2. Corrosion and pipe protection
3. Compressor stations
4. Super compressibility
5. Hydrates and dehydration
6. Gas conditioning
7. Flow formulae
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Gas Storage

Gas Distribution
1. System design and operation
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Gas Utilization
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Conversion Practices

Management Problems and Policies
1. Corporate structure
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3. Public relations

How to Use the Material

American Gas Fundamentals *is not intended as a training or service manual. It is a comprehensive compilation of basic gas facts to guide any gas utility employee toward a broader understanding of the industry as a whole. It is written in layman's language so that the technical fundamentals of every subject treated may be digested and understood by the non-technical reader.*

The series is designed to be removed from each current issue of American Gas Journal *and filed in a ring binder where it may be accumulated into a text book of permanent usefulness. Since the series will not run in sequence as outlined, material should be filed under the major subject head appearing in the upper right hand box at the head of each chapter.*

New subscribers to American Gas Journal *will be supplied free, upon request, with reprints of all previous chapters. Younger employees who may be required to serve in the armed forces will have put aside for them a full set of all texts that may be printed during their absence.*

AMERICAN Gas FUNDAMENTALS

MANUFACTURED GAS
2. REFORMED GAS

A CONTINUING EDUCATIONAL AND REFRESHER COURSE IN GAS TECHNIQUES, OPERATIONS AND MANAGEMENT

Processes for Reforming Natural Gas

THE term reforming, as used by the gas industry, means the chemical decomposition of a hydrocarbon gas such as natural gas by the use of heat to produce a larger volume of a lower heating value gas.

This type of decomposition or cracking action, technically termed pyrolysis, can be performed in a standard water gas set or in apparatus especially designed for the purpose. The usual objective of the process is to produce a gas suitable for distribution with carbureted water gas and coke oven gas, or to replace such gases.

It is generally believed that natural gas was first reformed in a water gas set in 1911. Since then the process has been successfully used in many cities, including Louisville, Toledo, Omaha, Chicago, Joliet, Binghamton and Washington, D. C. Today large volumes of natural gas are being reformed by gas companies serving some of the largest cities along the Atlantic seacoast.

Since the gas industry has spent billions of dollars in building pipe line systems to carry high Btu natural gas from the big producing fields to practically every part of our country, the question may well be asked—why reform natural gas into a lower Btu gas, once it has arrived at its destination?

Reasons for Reforming

There are several reasons why a manufactured gas company may decide to use natural gas for reforming and enrichment purposes rather than convert its operation to straight natural gas service.

The first consideration is generally that of supply. If the available supply of natural gas is insufficient to meet the full requirements of the winter period when demands are high, or if there is any question regarding future supplies being able to properly take care of expected growth in business, a gas company may prefer to continue on a manufactured gas basis using natural gas as an enriching medium to replace gas oil and as a raw material in the partial replacement of coke. As an enriching medium, natural gas can be used with 100 per cent efficiency; as a raw material in the production of reformed gas it can be used with an efficiency far above that of the blue gas process. Thus a manufactured gas company is able to make a decided improvement in the overall efficiency of gas production through the use of natural gas.

There are other important advantages obtained through the utilization of natural gas as a raw material in gas making. For example, the capacity of a given water gas set and plant is increased something like 50 per cent when natural gas is used for reforming and enrichment purposes.

In addition, with this type of operation a manufactured gas company is enabled to raise its calorific standard to 600, 700, 800 Btu or any desired calorific value and thus automatically increase the capacity of its distribution system without expense. Since the heat carrying capacity of a distribution system is directly proportional to the Btu value of the gas carried, it follows that this feature of natural gas utilization is a very attractive one, especially to companies whose distribution systems have been operating at near capacity. It follows, therefore, that many of the advantages and economies of straight natural gas service can be realized by using natural gas in manufactured gas operations.

Inasmuch as there are so many attractive possibilities for the use of natural gas for mixed gas service in which the reforming operation plays an important role, consideration is always given to this type of gas service wherever there is any uncertainty regarding the ability of existing natural gas supply facilities being able to supply the full requirements of straight natural gas service.

Enriched reformed gas can be produced which is interchangeable in the burners and appliances with ordinary carbureted water gas made from coke and oil, as was described in the chapter on Processes for Manufacturing Gas (February 1951 AMERICAN GAS JOURNAL). Thus in the event of a natural gas shortage or a complete failure in supply, a distribution company would be able to switch its operations from enriched reformed gas to part carbureted water gas, and if necessary, to straight carbureted water gas.

Raw Materials

The raw material in the gas reforming process may be any gaseous hydrocarbon or mixture of such compounds. From a practical standpoint, natural gas ranks first in importance, with refinery oil gas probably the second most important material. Propane and butane, or a mixture of these hydrocarbons, may also be reformed, but they are expensive raw materials which are used only in emergencies or for some special purpose. Since natural gas is of prime importance, the operations described herein will be based upon its use.

Natural gas is a mixture of hydrocarbons with very small amounts of inert gases. It consists mainly of methane, but contains a small amount of ethane and usually lesser amounts of propane and butane. Ethane, propane and butane are heavier hydrocarbons than methane, and are less stable. Therefore in the reforming process ethane is more readily decomposed by heat than methane and the temperature of the operation is regulated in accordance with the amount of methane that it is desired to crack and the heating value desired in the finished gas. The chemical reac-

tions of the reforming process are generally considered to be as follows:

Ethane splits up to form methane, carbon and hydrogen:

$$C_2H_6 \longrightarrow CH_4 + C + H_2$$

Methane splits up to form carbon and hydrogen:

$$CH_4 \longrightarrow C + 2H_2$$

Carbon reacts with steam to form carbon monoxide and hydrogen:

$$C + H_2O = CO + H_2$$

Carbon reacts with steam to form carbon dioxide and hydrogen:

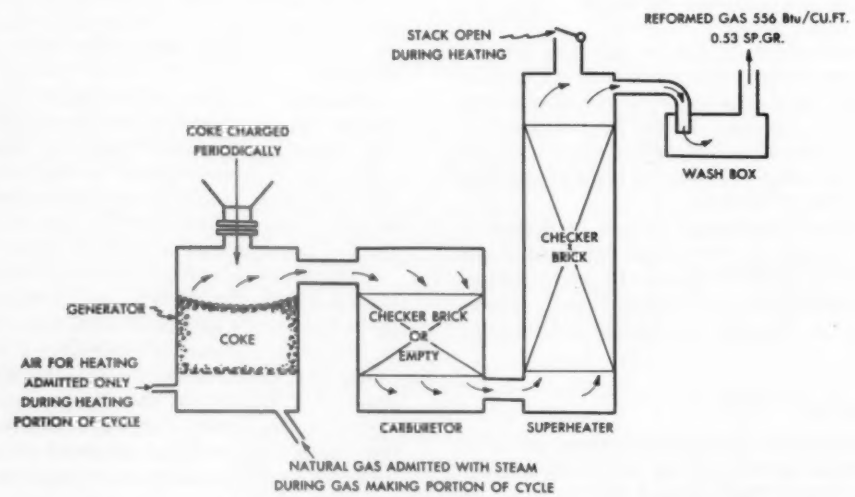
$$C + 2H_2O = CO_2 + 2H_2$$

Thus the final reformed gas consists of hydrogen, carbon monoxide, small amounts of carbon dioxide and undecomposed methane, with such volumes of nitrogen as may be obtained from gases of the blasting cycle. It will be noted that reformed gas with no decomposed methane would be similar in composition and calorific value to blue gas.

As in water gas practice, the air for blasting the fire and the steam are both metered and the volume of natural gas admitted to both up and down runs is suitably measured and the proper corrections made for temperature and pressure. When steam and natural gas are admitted simultaneously to the hot fuel bed of a water gas generator, a reformed gas is produced which, as has been shown, is composed chiefly of hydrogen, carbon monoxide and methane.

Care must be taken to use enough steam, because if too little steam is used, carbon resulting from the cracking of the natural gas will be carried along with the gas made. Free carbon is not only an evidence of inefficiency in operation, but is also an objectional constituent in the gas. With sufficient steam, however, the amount of carbon carried by the gas is negligible.

The reformed natural gas usually does not have sufficient calorific value for city distribution purposes, and it is therefore enriched by being mixed with natural gas at some suitable point in the plant layout.



FUEL BED REFORMING IN A CONVERTED THREE SHELL WATER GAS SET

Reforming in Water Gas Generators

This process is called fuel bed reforming. It is carried out in conjunction with the manufacture of blue water gas.

Natural gas is admitted to the water gas generator on the make run with the steam, although the back run is sometimes made only with natural gas. The operation may be carried out in single blue gas generators or in existing three-shell water gas sets. As is shown in the schematic diagram on this page, the carbureter may contain checker brick or may be empty, since neither the carbureter nor superheater is required in fuel bed reforming.

It is possible to vary not only the calorific value, but also the specific gravity of the reformed gas over a considerable range by varying the temperature of the fuel bed and the amounts of steam and natural gas passed through the fire. The great flexibility of the operation permits the production of a gas ranging from 300 to over 500 Btu and from .31 to .7 in specific gravity. Specific gravity of the enriched reformed gas can be varied from about .5 to around .7, depending on methods of operation used, and the calorific value of the final gas can be varied, as desired, up to 800 or 900 Btu per cubic foot.

As stated before, the capacity of a water gas set on reformed gas operation is much greater than its normal rated capacity. The labor in making reformed gas is less than that required for carbureted water gas, as there is no work required for the unloading, storing and pumping of gas oil. Coke requirements can be greatly reduced, if desired, to

as low as five or six pounds per Mcf of gas produced as compared to more than 25 pounds required for a typical carbureted water gas operation or approximately 34 pounds for straight blue gas. Boiler fuel requirements are less as less steam is required, maintenance and repair charges are less, and purification cost is greatly reduced.

An analysis of a typical fuel bed reformed gas is:

Illuminants	0.5
CO	9.3
H_2	28.0
CH_4	26.7
C_2H_n	0.0
CO_2	5.4
O_2	0.5
N_2	29.6
Btu	385
Sp. Gr.	0.667

The raw material requirements per Mcf of the above gas would be:

Coke	5.4 lbs.
Natural gas	367 cu. ft.
Steam	5.9 lbs.

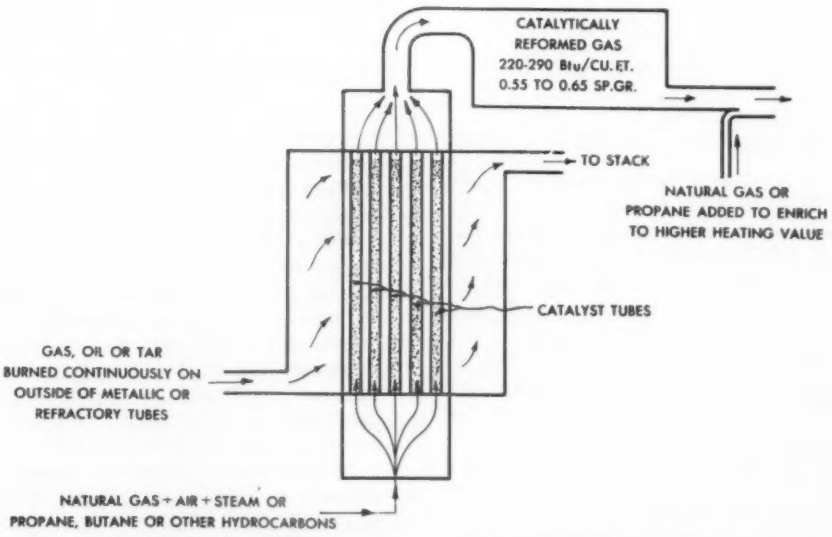
The raw material requirements per Mcf of 530 Btu gas would be:

Coke	4.16 lbs.
Natural gas	512 cu. ft.
Steam	4.54 lbs.

Catalytic Reforming Equipment

A comparatively recent development of importance is the catalytic reforming process. A number of such plants have been built and are now producing large volumes of reformed gas economically and efficiently. Most of these processes operate in a continuous manner (instead of cyclic, as in the water gas process) and produce a reformed gas that may range from 220 to 400 Btu in heat value. This gas is then enriched to the desired heating value by mixing it with natural gas.

A catalyst is a substance which causes or accelerates a desired chemical reaction without being permanently affected by the reaction. In the reforming of natural gas the catalyst may be a form of nickel supported on pieces of refractory metal. The nature of the catalyst is very important, since the efficiency with which hydrocarbon gases are converted into usable low Btu gases is dependent upon its activity.



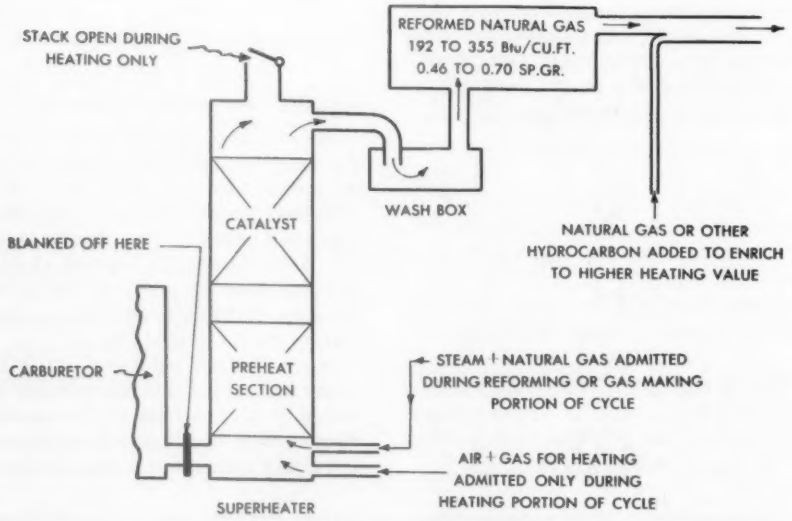
CATALYTICALLY REFORMED GAS—A CONTINUOUS PROCESS

Briefly, a plant of this type consists of tubes containing the catalyst mounted in a furnace with provisions for heating the tubes externally by the combustion of any available fuel. The hydrocarbon to be reformed—natural gas, propane, butane, gasoline or light gas oil—is passed through the tubes in contact with the catalyst at carefully controlled temperatures. Since the operating temperature may be 1500° F or higher, it is necessary that the tubes be fabricated from an alloy metal which will withstand the temperature involved. The calorific value of the reformed gas can be varied somewhat by the ratio of steam and air fed to the tubes with the natural gas or other hydrocarbon being reformed. The composition of the reformed gas is similar to that produced in the water gas process.

This reformed gas can be enriched with natural gas to produce a gas of the desired calorific value. A 530 Btu gas would be a mixture containing 77 per cent reformed gas and 23 per cent natural gas.

A typical 530 Btu gas thus made would analyze as follows:

Illuminants	0.4
CO	7.2
H_2	21.6
CH_4	40.8
C_2H_6	1.5
CO_2	4.3
O_2	0.4
N_2	23.8
Btu	532
Sp. Gr.	0.654


STACK OPEN DURING HEATING ONLY
REFORMED NATURAL GAS
192 TO 355 Btu/CU.FT.
0.46 TO 0.70 SP.GR.
WASH BOX
CATALYST
BLANKED OFF HERE
NATURAL GAS OR OTHER HYDROCARBON ADDED TO ENRICH TO HIGHER HEATING VALUE
CARBURETOR
PREHEAT SECTION
STEAM + NATURAL GAS ADMITTED DURING REFORMING OR GAS MAKING PORTION OF CYCLE
AIR + GAS FOR HEATING ADMITTED ONLY DURING HEATING PORTION OF CYCLE
SUPERHEATER

CATALYTICALLY REFORMED GAS BY A CYCLIC PROCESS IN A MODIFIED WATER GAS SET

Modified Water Gas Process for Catalytic Reforming

A process has been developed for catalytically reforming natural gas in a modified water gas set.

In this new process only the superheater of a three-shell water gas set is used. The superheater is first blanked off from the carbureter and generator, or disconnected entirely. This single shell is then equipped with a combustion chamber preheat bed and catalyst bed.

The operation of this process is cyclic. The heating gas mixture is introduced into the combustion chamber and burned, and the blast gases pass through the preheat and catalyst sections of the shell. When the proper temperatures are reached, the heating mixture is shut off and steam and natural gas are admitted for the run or reforming cycle. Reformed gas, after leaving the catalyst bed, passes through a wash box and then is cold enriched with natural gas at some convenient point.

The reformed gas produced by this new process can readily be varied from 192 to 355 Btu in calorific value, and from .46 to .70 in specific gravity. It might be mentioned, also, that reformed gas made by either this cyclic catalytic process, or the continuous process, is practically free of H_2S and in this respect has an advantage over a gas made by fuel bed reforming.

The catalyst used in this process is a commercial nickel catalyst which, after 4½ months of operation in an experimental plant, showed no deterioration or evidence of powdering. Its useful cracking life has not been determined as yet, but it is expected to be at least one year.

From the experience gained with this single shell superheater unit, there is reason to believe that even better overall results and greater capacity would be obtained with a two-shell unit; that is, one using both the superheater and carbureter. It is expected, therefore, that the new cyclic catalytic plants will be made up of two shells.

Most of the reformed gas made to date has been produced in standard water gas sets by the so-called fuel-bed process. Results obtained with the newer catalytic processes, however, have been so satisfactory that they probably will increase in importance. Catalytic reforming undoubtedly possesses certain advantages over fuel-bed reforming and the main question in choosing between these processes is—do the advantages of catalytic cracking offset its greater investment. The essential factor in comparing different reforming processes is cost of operation.

This chapter on processes for reforming natural gas was prepared under the supervision of Charles R. Bellamy, consultant.

Illustrations are by courtesy of the Koppers Company, Inc.

Contract and Sale Legalities Are Problem To Gas Corporations

by Leo T. Parker

Attorney at Law, Cincinnati

RECENTLY during the writer's contact with readers of AMERICAN GAS JOURNAL, several legal questions having special interest to executives and managers and employes of gas corporations have been presented. Therefore, most important of these questions and answers have been selected, and leading higher court citations are included in the opinions.

Chattel Mortgage

Question: Please explain the legal difference between a conditional contract of sale, a chattel mortgage, and a lien. How can I definitely know when a transaction or sale changes ownership to gas appliances sold through our company?

Answer: In a leading case (141 Atl. 880) the court explained in detail the distinction between a sale and a mortgage as follows:

"The distinction between a conditional contract of sale and a mortgage is that a sale is a transfer of the absolute title for a price, whereas a mortgage is a conveyance of property *as security* for the payment of a debt, subject to the condition that the title shall revert to the person giving the mortgage."

Hence, the transaction is a mortgage if the transfer is intended to *secure* an existing indebtedness. However, it is a conditional contract of sale if the debt is extinguished, or if the money advanced is not a loan, particularly if the one who receives it has the privilege of refunding the money if he chooses, and thereby entitling himself to recover possession of the property.

A lien is in legal effect a mortgage which is not recorded and the property remains in the control of a person other than the one holding the lien.

A seller may take possession of appliances, for which the purchaser refuses to pay, on either a conditional contract of sale or a mortgage. An advantage of a conditional contract is that the seller may repossess the merchandise without filing a suit, whereas a chattel mortgage must be foreclosed by a court procedure before the seller can repossess the merchandise from a defaulting purchaser.

Question: Sometime ago our gas corporation signed a distributor's contract with a manufacturer. This contract made our corporation the exclusive distributor of the manufacturer's products in this territory. The contract stated that either the manufacturer or our corporation could cancel the contract at any time by giving 30 days notice. We spent considerable money and also time during the past several months in developing this territory and purchased quite a stock of merchandise. A few days ago the manufacturer notified us that our contract would be cancelled in 30 days. My question is: Can we sell the merchandise we have on hand after the contract is cancelled, and can we sue and recover damages from the manufacturer?

Answer: Yes, you can sell out your present stock. Also, the manufacturer must pay your corporation a sum of money as damages which a jury may decide your corporation deserves. The courts hold that a distributor's contract cannot be cancelled by a manufacturer without liability on the part of the latter if the testimony shows that the distributor acted in good faith and expended time and money in developing and distributing the manufacturer's product. This is the law although the contract clearly and plainly gives the manufacturer the right to cancel the contract at any time.

For example, in Far Co. v. Globe Corp., 161 Fed. (2d) 811, the testimony showed that a manufacturer and a distributor signed a written contract which specified that the contract could be cancelled at any time by either party. The contract recited that the distributor was to sell the manufacturer's appliances in a designated territory to which the distributor was to confine his selling efforts exclusively. The contract further specified the annual quota for the territory. The distributor immediately ordered out and paid for one-half the specified quota, and then proceeded to spend his time, effort and money to sell the manufacturer's products. Sometime later the distributor gave the manufacturer an order for the balance of the yearly quota.

COOKING WITH GAS AT PHILADELPHIA

A commercial cooking exhibit, sponsored by the Pennsylvania Gas Association and the Philadelphia Gas Works Co., was held February 12-15 at the Eastern Regional Restaurant Convention and Exposition at Philadelphia. Pictured is part of the 42-foot exhibit in which nine leading manufacturers of restaurant equipment cooperated.

Soon afterward the manufacturer cancelled the distributor's contract.

The distributor sued the manufacturer for damages contending that the latter had no right to cancel the contract notwithstanding the contract contained a clause which gave either party the right of cancellation. This court rendered a decision in favor of the distributor holding that where a distributor incurred expense and devoted his time and labor to an exclusive agency, without having had reasonable opportunity to recoup, he is entitled to damages or compensation from the manufacturer although the contract provides that the manufacturer can terminate the agency and cancel the contract at anytime. The court said:

"All we intend to say is that the contract and the approval by the defendant (manufacturer) of the acts performed by the plaintiff (distributor) including the obtaining of the 2,500 sales orders, and the cancellation of the contract before the plaintiff had a chance to recoup any of the expenses incurred and laid out, were facts sufficient to withstand the motion. . . . They showed that the plaintiff (distributor) was entitled to some relief."

For comparison, see Bendix, Inc. v. Accessories, 129 F. (2d) 177. This court held that where the testimony shows that nothing has been done by the distributor in reliance on an exclusive agency the manufacturer may cancel the contract at anytime and exactly in accordance with the terms of the contract. This court said:

"Where the unrestricted right of cancellation is reserved to one or both parties, contracts are binding only to the extent that they have been performed."

Question: Our gas corporation has on sale and for installation to domestic and industrial gas consumers various appliances. Under what circumstances is our corporation liable on an implied guarantee?

Answer: Recently a higher court laid down important law, as follows: (1) Where a buyer of gas appliances makes known to a seller the particular purpose for which the appliance is required, there is an implied warranty that appliance shall be reasonably fit for such purpose.

See United States Casualty, 67 Atl. (2d) 880. This court held a seller liable where the testimony showed that he failed to supply an appliance reasonably fit for the purposes made known to the seller by the buyer. This court explained that an implied guarantee is equally as effective as an expressed guarantee. The court said that a seller can be relieved from liability on an implied guarantee by inserting a clause in the contract to the effect that the seller does *not* impliedly give a guarantee.

Question: By what procedure or plan can a gas works owned by a municipality exceed the debt limitation specified by a state law?

Answer: Recently a higher court held that revenue bonds secured by a mortgage or deed of trust on a municipally owned plant are not a "legal debt" and not effective to exceed the debt limitation of the city if the bonds contain a clause that such bonds are not to be paid out of the revenues of the municipal system.

For illustration, in City of Mobile v. City of Mobile, 43 So. (2d) 409, a state law was litigated which limits the amount of debts which shall be assumed by municipalities.

A city's board decided to issue bonds secured by a mortgage on the municipal plant. However, it was understood that such bonds would not constitute a debt or obligation of the city and would be exempt from taxation under laws of the state. In fact each bond contained a stipulation that "this bond is not a debt" of the city, within the meaning of the constitution of the state. Further the bond stipulated that the city was not liable on the bond or the interest except from revenues derived from operation of the plant, and "no holder of this bond shall ever have the right to compel any exercise of the taxing power of the City or the application of any funds other than the revenues provides in the resolution for the payment of this bond and the interest hereon."

Although the bond issue exceeded the debt limitation specified by a state law, the higher court held the bond issue valid, saying:

"If the revenue bonds are issued and sold as prescribed, they will not constitute a debt of the city and that such bonds will not be an obligation on the part of the city directly or indirectly. . . . It is expressly provided therein that 'no foreclosure proceeding or sale shall ever be had with respect to the mortgaged property or any part thereof.' "

Commission Regulation

Question: When determining whether a public service commission has jurisdiction over a gas corporation, will the court be guided exclusively by the articles of incorporation?

Answer: In Natural Gas Service Co. et al. v. Serv-Yu Cooperative, Inc., 213 Pac. (2d) 677, the higher court held that whether a corporation is a public service corporation subject to jurisdiction of the public service commission and required to secure a certificate of public convenience and necessity before buying natural gas from a certificated public service corporation for use of its members, would be determined by what its articles and by-laws authorized it to do, rather than by what was being done at the time of the decision or by what the corporation might do in the immediate future.

Question: Can a state's public service commission take jurisdiction over an out-of-state gas corporation which pipes gas into the state and supplies gas directly to large industrial users? Please cite late higher court decision on this law.

Answer: According to a late higher court decision the answer is yes. In Panhandle Eastern Pipe Line Co. v. Michigan Public Service Commission, 44 N.W. (2d) 324, the higher court held that the right to sell natural gas in Michigan by an interstate pipe line carrier direct to consumers for their own use, and not for resale in a municipality where another public utility was rendering the same service, is within jurisdiction of the Michigan Public Service Commission.

The facts of this late case are that the Panhandle Eastern Pipe Line Co., a Delaware corporation, is engaged in the interstate transportation of natural gas by pipe line from Texas and other states into Michigan. It is an interstate natural gas pipe line company, subject to regulation by the Federal Power Commission under the Federal Natural Gas Act, 15 U.S.C., Section 717. It sells the greater part of its natural gas to local public utilities for resale for ultimate consumption. A part of its natural gas is sold direct to local industrial consumers, known as "direct industrial sales." It entered into a contract with the Ford Motor Co. to sell natural gas direct to this company at its Dearborn plant for its own consumption. The plant of the company is within a municipality already served by the Michigan Consolidated Gas Co., a public utility engaged in selling natural gas to consumers in the municipality after having been granted a certificate of public convenience and necessity to do so.

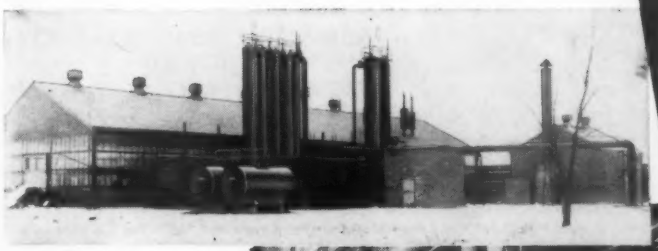
The Michigan Consolidated Gas Co. filed a complaint with the Michigan Public Service Commission and, after notice and a hearing, the commission ordered that Panhandle Eastern Pipe Line Co. "cease and desist from making direct sales and deliveries of natural gas to industries within the state of Michigan, located within municipalities already being served by a public utility, until such time as it shall have first obtained a certificate of public convenience and necessity from the commission to perform such services."

In subsequent litigation, the higher court held that, although the Panhandle Eastern Pipe Line Co. was engaged in interstate commerce and transportation

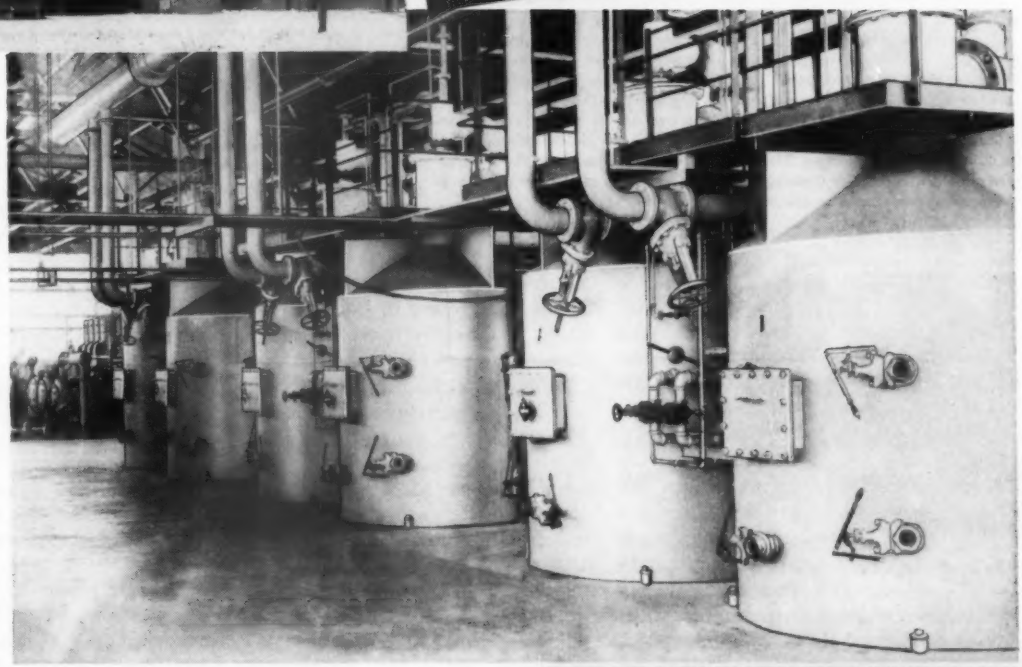
(Continued on page 46)

Dayton-Faber Gas Process

HIGH - MEDIUM - LOW B.T.U. GAS
OIL GAS - GAS REFORMING
BY PARTIAL COMBUSTION WITH
AIR OR AN AIR-OXYGEN MIXTURE
OIL GAS ENRICHED WITH PROPANE



SARNIA PLANT
Main Building
Scrubber Oil Tanks
Precipitator Bldg.
and Boiler House



SARNIA PLANT
Six Reformed Gas Generators.
Total capacity
9 million c.f. per day

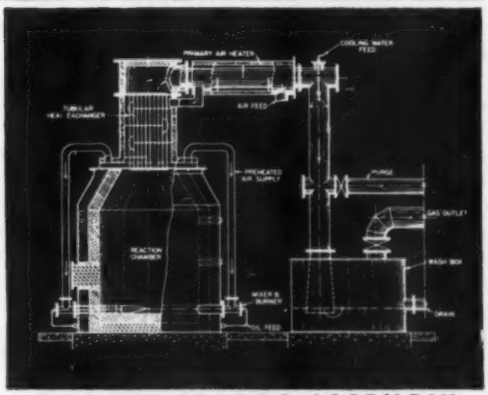
Maximum flexibility because the same plant will produce Oil Gas or will reform Natural Gas, Refinery Still gas or Liquid gases and can be placed in operation in one hour's time from a cold start. Minimum labor requirements.

Of special value as a stand-by plant, peak load plant or for peak load shaving.

In the installation pictured, refinery cracking still gas is reformed to an output of 1000 B.T.U. gas and mixed with natural gas for service to the consumers.

This plant, located at Sarnia, Ontario, enabled Union Gas Company of Canada Limited to furnish gas service to 70,000 consumers during several years of natural gas deficiency. The plant has been in operation since 1942.

At Windsor, Ontario, Canada, the same company maintains a Dayton-Faber oil gas plant which operated during the winter months of the same period with the use of Propane for enrichment to meet peak load requirements.



GAS GENERATOR ASSEMBLY

JOHN INGLIS CO. LIMITED
Engineers • Manufacturers
TORONTO • CANADA
DISTRICT OFFICES: MONTREAL, WINNIPEG, CALGARY, VANCOUVER

Inglis
CANADA

Index of Yields : Selected Utilities Stocks

	Mar. 1951	Feb. 1951	Jan. 1951	Dec. 1950	Nov. 1950	Oct. 1950	Sept. 1950	Aug. 1950	July 1950	June 1950	May 1950	Apr. 1950
Natural Gas Transmission Companies	5.38%	5.31%	5.36%	5.97%	5.62%	5.19%	5.71%	5.46%	5.76%	4.86%	4.70%	4.77%
Natural Gas Transmission & Distribution Companies	5.35	5.31	5.47	5.67	5.46	5.40	5.61	5.71	5.79	5.29	5.11	5.14
Manufactured & Mixed Gas Companies	5.22	5.21	5.22	5.56	5.46	5.24	5.52	5.55	5.76	4.98	4.66	4.77
Class "A" Electric Companies	5.49	5.65	5.62	6.19	6.03	5.56	5.67	5.59	5.64	4.94	5.13	5.24
Class "B" Electric Companies	5.66	5.78	5.80	6.38	6.06	5.99	6.06	6.35	6.41	5.58	5.30	5.37

Method of Compiling Index of Yields

This is a straight arithmetical index of comparative yields obtainable on a selected group of gas and electric utility industry common stocks.

The companies comprising this index have been selected by the AMERICAN GAS JOURNAL as providing a representative cross-section of each industry, from the standpoint of geographical diversification and of the relative importance of the individual companies in their areas.

No effort has been made to weight the average to give effect to changes in capitalization or in dividend rates because the yields afforded on the issues reflect such changes. The index is designed to show the rate of return and not necessarily market movements on the stocks comprising it.

The companies used in compiling this index are:

Natural Gas Transmission Companies: El Paso Natural Gas Co.; Northern Natural Gas Co.; Panhandle Eastern Pipe Line Co.; Southern Natural Gas Co.; Tennessee Gas Transmission Co.

Natural Gas Transmission and Distribution Companies: Columbia Gas System, Inc.; Consolidated Natural Gas Co.; Lone Star Gas Co.; Oklahoma Natural Gas Co.; Pacific Lighting Corp.

Manufactured and Mixed Gas Companies: Bridgeport Gas Light Co.; Brooklyn Union Gas Co.; United Gas Improvement Co.; Peoples Gas Light & Coke Co.

Class "A" Electric Companies: Boston Edison Co.; Commonwealth Edison Co.; Houston Lighting & Power Co.; Southern California Edison Co., Ltd.

Class "B" Electric Companies: Dayton Power & Light Co.; Hartford Electric Light Co.; Pennsylvania Power & Light Co.; Public Service Co. of Colorado; San Diego Gas & Electric Co.

John F. Falvey

NERVOUSness has been the keynote of the security markets during recent weeks. In fact, watchful waiting seems to be the order of the day so far as bonds are concerned. In the two weeks which have elapsed between the withdrawal of Federal Reserve Bank support for the government bond market on March 8 and the time of this writing, only one issue of corporate debt securities has been offered at competitive bidding.

The test of the market finally occurred on Tuesday, March 27, when 40 million dollars of Consumers Power Co. bonds came to market. This issue went to the public at a price to yield 3.05 per cent. Price to the company was 100.80467 for 3 1/8ths for an interest cost of 3.085 per cent.

This represents an increase of around 40 basis points in the yield for high grade corporate obligations as a group and a similar increase in the interest cost to Consumers Power from what would have prevailed, in expert opinion, prior to pulling of the peg on Government obligations a few weeks ago.

This is the highest interest rate since 1939 for a high grade bond issue such as Consumers. A factor about the sale was the close bidding for the issue, indicating unanimity among investment banking firms.

Utility managements are keenly aware of what the new trend in the bond market means, because they again will be in the foreground of borrowers endeavoring to raise the tremendous sums still required to pay for expansion programs.

While corporations of all types had to rely on the securities markets for only 19 per cent of their property additions and improvements in 1950, compared with 23 per cent in 1949, the total of all corporate offerings of securities last year was $6.3 billion, against $6.1 billions in 1949. This gives some idea of the expanding nature of industry, with national defense needs now superimposed on the growing home front.

Utility companies, furthermore, accounted for 43 per cent of the financing done by industry as a whole in 1950. This is an increase of about 40 per cent, in the space of two years, in the participation of utilities in the total of corporate financing. In 1948 the utility companies had accounted for only 31 per cent of corporate issues as a group.

It is interesting to note the increasing importance of common stocks in the over-all investment picture. No less than 28 per cent of the new money for industry was raised through this route in 1950, compared with 20 per cent in 1949 and with a mere 15 per cent in 1948.

Naturally this trend toward more and more equity stock financing is heartening, so long as it can be done on an advantageous price and yield basis to the utility company issuers. Utility offerings of stock which have come to market during the recent past have been favorably received and the action of the stock market currently is not such as to discourage the raising of additional equity money.

The stock market recently has been going through a process of leveling off. It has had its ups and downs and now is about where it was a month ago. One singular development is that expanding merchandise inventories have replaced the international situation as a source of worry among stock market observers and important investors. Sizable inventories and a faster tempo of production as related to consumption already have necessitated some industrial companies to resort to temporary shut-downs of their plants and it remains to be seen whether this trend is increased or whether expanding demand from the military and from the home front consumers permits lightening of the inventory pile.

At all events the situation is one that will bear considerable watching over the weeks and months ahead.

Even though purchases of stocks by life insurance companies under a bill soon to become law in New York State will be considerably smaller than generally is anticipated (AMERICAN GAS JOURNAL, March 1951), a sizable backlog of investment funds is being accumulated by other institutional channels, such as investment trusts, pension funds, etc.

These sources already have accounted for some large-scale buying during recent weeks and their presence on the side lines awaiting advantageous investment opportunities offers a possible cushion to market recessions. This is something which had been lacking in previous years.

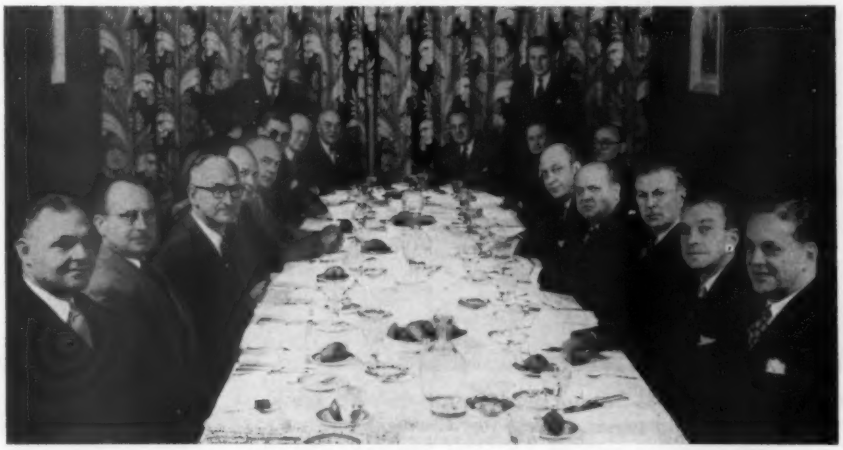
Recent annual reports and those still coming to hand make for satisfactory reading and even with the impact of higher taxes operating returns for the first quarter of 1951 are expected to

continue at a high level. This will permit continuance of a fairly high level of dividend payments.

Further increases in costs and in taxes are in prospect. Both factors will serve to absorb an increasing proportion of revenue gains in prospect for the utilities—both electric and gas. Sales volumes and revenues are expanding at a rapid and in many instances at a record high rate. While inability of some of the utilities to absorb these rising expenses is necessitating recourse to regulatory agencies for higher rates, the move along this line has not reached wholesale proportions.

Indicative of progress in this respect was the recent experience of Southwestern Electric Service Co. which in the short space of four months—from November 1950 to February 1951—obtained permission of the various Texas municipalities it serves to raise rates by a maximum of 11 per cent and an average of 8 per cent. It is significant that the increase in rates met with practically no opposition.

AGA National Advertising Committee Meets in New York



Standing at rear are Michael E. Shea, Lynchburg, and W. B. Hewson, Brooklyn.

Seated at left, from bottom to top:
H. V. Potter, New York
Carl H. Horne, Birmingham
W. M. Jacobs, Los Angeles
Dean A. Strickland, Houston
R. G. Barnett, Portland
Leon Ourusoff, Washington
J. P. Leinroth, Newark
J. J. Quinn, Boston

Seated at right, from top to bottom:
Christy Payne, Jr., Pittsburgh, chairman
C. W. Person, New York, secretary
R. W. Fenton, Chicago
Chester L. May, Dallas
Fred W. Dopke, Indianapolis
Jesse L. Johnson, Providence
J. W. West, Jr., New York
I. K. Peck, Pittsburgh

AGA-EEI Accounting Confab To be Held April 23-25

More than 800 accountants from gas and electric companies will convene at the Hotel Sherman, Chicago, on April 23, 24 and 25, to discuss problems and exchange information on developments in accounting practices.

Under the leadership of Alan A. Cullman, Columbia Engineering Corp., chairman of the American Gas Association Accounting Section, and his counterpart, R. H. Smith, Cleveland Electric Illuminating Co., chairman of the Edison Electric Institute Accounting group, a comprehensive program has been arranged.

Three leaders of utility companies are listed as speakers at the opening session. They are: E. L. Lindseth, President, Cleveland Electric Illuminating Company, who has recently completed a term as President, Edison Electric Institute; James F. Oates, Jr., chairman, The Peoples Gas Light and Coke Co., Chicago; and A. L. Tegen, President, General Public Utilities Corp., New York.

Group meetings will be held on Tuesday and Wednesday. Committee chairmen will lead and moderate discussions of general accounting, depreciation accounting, internal auditing, materials and supplies, property records, taxation accounting, accounting employee relations and customer activities group.

Luncheons at 12:30 P.M. Tuesday, will be sponsored by the General Accounting Committee, General Activities group, Customer Accounting group, Customers Collection group and the Customers Relations group. An imposing list of speakers has been compiled to speak at the luncheon and the individual group meetings. Included in this list are: C. G. Blough, American Institute of Accountants; L. A. Diamond, tax counsel with Chadbourne, Wallace, Parke, Whiteside, Wolff & Brophy, New York law firm; Dr. Melchior Palyi, Chicago economist who has selected as his topic, "Accounting After Bomb Destruction," and Joseph Rachor, of the accounting firm of Arthur Andersen & Company.

Other speakers are: V. K. Rowland, Detroit Edison Co.; M. R. Scharff, consulting engineer from New York; E. M. Spencer, Detroit Edison Co., and K. R. Wells, American National Bank & Trust Co. of Chicago.

Six speakers will present views on the topic, "Monthly Billing versus Other Billing" at the Wednesday morning meeting sponsored by the three customer activities committees.

Pacific Coast Conference Will Consider PAR Plan Research

The 1951 Pacific Coast Research Conference will be held in Berkeley, California, April 26 and 27, in the Claremont Hotel. The conference will be coordinated with The Customers Service Conference of Pacific Coast Gas Association, which will be held in Berkeley, April 25 and 26. Devoted to all phases of research and development in the utilization field, the conference will cover both technical and practical phases of AGA PAR plan research.

Men from AGA laboratories, Purdue University, and other institutions that are engaged in this program will give information on what is being done and what the progress being made means, and how it can be interpreted and put to best use.

Latest developments and thinking concerning venting, ignition, and combustion will be thoroughly explored and explained. Discussions and question and answer periods will be featured.

Guy Corfield, research engineer of Southern California Gas Co. is chairman of the conference, which is being sponsored by the AGA committee on domestic gas research, R. J. Rutherford, Worcester Gas Light Co., chairman.

United Gas Pipe Line Asks FPC To OK Additional Facilities

United Gas Pipe Line Co., of Shreveport, has asked the Federal Power Commission for authority to construct approximately 50 miles of pipe line in southeastern Alabama and northwestern Florida to supply natural gas to present customers and to new markets including the Naval Air Station at Saufley Field and the Elgin Field Air Force Base.

The proposed $1,945,000 project would include 39.4 miles of 16-inch loop line paralleling United's existing Pensacola lateral from a point in Baldwin County, Ala., southeasterly to a point in Escambia County, Fla.; and two laterals, one about six miles long paralleling United's Gulf Power Co. lateral, and the other, five miles long, extending to Saufley Field.

The application says that the proposed construction would bring the total capacity of United's Pensacola pipe line facilities up to about 75,700,000 cu. ft. per day.

NEW ENGLAND GAS ASS'N ELECTS OFFICERS

Front row (l. to r.)—Gordon G. Howie, incoming President (vice-president and general manager, Cambridge Gas Light Co.); John A. Hiller, retiring President (assistant vice-president, Portland Gas Light Co.); Sherman R. Knapp, first vice-president and chairman, program committee (executive vice-president, The Connecticut Light & Power Co., Hartford.)

Rear row (l. to r.)—Jesse L. Johnson, second vice-president (vice-president, Providence Gas Co.); Earl H. Eacker, chairman, Nominating Committee (President, Boston Consolidated Gas Co.); Otto Price, treasurer (vice-president, Boston Consolidated Gas Co.); Clark Belden, clerk (managing director.)

Coke Production Increases 13 Per Cent

According to preliminary data submitted by coke producers to the Bureau of Mines, United States Department of the Interior, production of coke in the United States in 1950 increased 13 per cent over the 1949 total and amounted to 72,097,669 net tons. This gain was due to a 10 per cent rise in oven-coke output and to a 66 per cent advance registered by beehive ovens. The overall gain in coke production would have been even larger if both the slot-type and beehive ovens had operated at capacity levels in the first quarter of 1950.

Negotiation of a new contract during that period between bituminous-coal producers and mine workers caused many of the oven-coke plants to slow their operations in order to conserve their coal stocks and a majority of the beehive plants were idle during this period. With the return to work of the bituminous-coal miners on March 6, production of both oven and beehive coke increased rapidly thereafter reaching a peak output of 214,514 tons per day in October. One of the important developments in the coke industry in 1950 was the remarkable comeback made by beehive ovens.

Oven-coke plant operators continued to build new ovens at a rapid pace but the extent of construction was limited to the availability of refractories and other necessary materials. According to preliminary figures received by the Bureau of Mines from operators, a total of 552 new ovens were completed and placed in operation. However, it is to be noted that only a small number of the new ovens can be considered additional capacity as 571 old ovens were dismantled and the net gain in annual capacity amounted to but 133,000 tons. Although complete figures have not been received from the operators on the number and capacity of new ovens under construction at the close of the year, it is estimated that approximately 592 new ovens with an annual coke capacity of 3,474,000 tons were under construction.

Consumption of coke, by uses, closely followed the pattern of previous years. Shipments to blast furnaces accounted for 83 per cent; to foundries, five per cent; to miscellaneous industrial plants (including coke for producer gas and water gas manufacture), nine per cent; and three per cent for domestic heating.

Production of coal chemicals, which necessarily parallel oven-coke output, registered gains over 1949 but were lower than the 1948 totals.

Mergers and Consolidations Made by United Natural

Approval of the merger and consolidation of United Natural Gas Co., Ridgway Natural Gas Co., St. Marys Natural Gas Co., Smethport Natural Gas Co. and Mercer County Gas Co., as proposed by the five companies, has been granted by the Pennsylvania Public Utility Commission. A charter and letters patent have been issued by the governor of the state to the merged and consolidated corporation, United Natural Gas Co.

The five companies were wholly owned subsidiaries of National Fuel Gas Co., the Ridgway and St. Marys properties having been acquired in 1928, Smethport in 1930 and Mercer County in 1933. United Natural, the major company in the group, is one of the oldest natural gas utilities.

On the dates of acquisition by National Fuel, the smaller companies were placed under the same management as United Natural with headquarters at Oil City, and they were operated as separate companies until the date of the merger.

The merger of the companies will result in some changes in operations as many of the leases and gas lines are in close proximity to each other. It will also result in simplification of accounting procedures. The most compelling reason for the merger is the diminishing supply of natural gas in the northwestern Pennsylvania fields and the growing dependence of the smaller companies' properties on the United system for adequate gas supplies.

H. S. Rose, UNG President, has announced there will be no change in gas service conditions because of the merger, and all policies pertaining thereto will continue without change. The only change, so far as the public is concerned, is in the name of the company supplying gas service in the communities formerly supplied by the Ridgway, St. Marys, Smethport and Mercer County companies.

Servel Introduces Electric Refrigerator to US Market

Servel, Inc., announced that it will shortly offer for sale in this country the electric absorption-type refrigerators which were previously made for export markets only.

Servel's chief product for the past 25 years has been gas-operated absorption refrigerators.

"The gas refrigerator will continue to receive major emphasis in our sales program," W. Paul Jones, Servel President, said. "The electrically operated refrigerator is being introduced in the United States to strengthen and support the position of the absorption refrigerator through larger volume and lower prices."

Because of material shortages, production of electric models will necessarily be limited for the present, Mr. Jones indicated.

"Servel promotion of the gas refrigerator will not be lessened one bit," Mr. Jones declared. "But the introduction of the electric absorption refrigerator in the United States will help to increase our total volume of production. This will favorably affect our ability to produce the best possible refrigerator, regardless of fuel, at the lowest possible price. Everyone who sells or purchases a Servel refrigerator will benefit in the long run from this expansion of our line."

Hulcy To Be Feature Speaker At Indiana Meeting

D. A. Hulcy, President of American Gas Association, will headline the speakers' program for the 41st annual convention of the Indiana Gas Association at French Lick, April 26-27.

Mr. Hulcy, also President of the Lone Star Gas Co. of Dallas, will speak on "PAR at Work."

The program includes:

"The Automatic Gas Clothes Dryer—a Great New Profit Opportunity," Charles Rippe, sales director, Hamilton Manufacturing Co., Two Rivers, Wis.; "The Death of a Salesman—Its Implications in the Gas Industry Today," Howard D. Valentine, manager sales promotion, Peoples Gas Light and Coke Co., Chicago; "The Discovery and Development of Leadership in Industry," Dr. R. K. Burns, executive officer, University of Chicago; "Trail Blazing in Industry," T. A. Boyd, research laboratory consultant, General Motors Corp., Detroit; and "Americans Thrive on Struggle," Dr. M. O. Ross, President, Butler University, Indianapolis.

Transcontinental To Increase New Jersey Facilities

The Federal Power Commission has authorized Transcontinental Pipe Line Corp., of Houston, to construct a pipe line extension in New Jersey and to increase the total horsepower of six authorized compressor stations on its natural gas transmission system.

Temporary authorization to construct and operate the facilities was granted by orders of the commission dated October 18 and November 6, 1950, but engineering difficulties have necessitated the change. The newly authorized pipe line contruction includes 8.5 miles of 30-inch line and 8.5 of 10¾ inch line extending from a point on Transcontinental's main transmission line in Bergen County, N. J., to the Paterson Gas Works of the Public Service Electric and Gas Co. Estimated cost of this lateral is $1,785,988.

The line was originally authorized to have been 12 miles long, of 8⅝ inch diameter pipe, extending from Transcontinental's main line to the Paterson Gas Works.

Gas Range Shipments Up During February 1951

Shipments of domestic gas ranges totaled 249,700 units during February 1951, as compared with shipments of 209,000 in February 1950. This is an increase of 19.5 per cent.

During the first two months of 1951 shipments of domestic gas ranges totaled 474,800 units as compared with shipments of 374,000 units during the similar period of last year.

The latest figures on shipments of electric ranges relate to January 1951, when 151,000 units were shipped. Shipments of domestic gas ranges during that month were 225,100 units.

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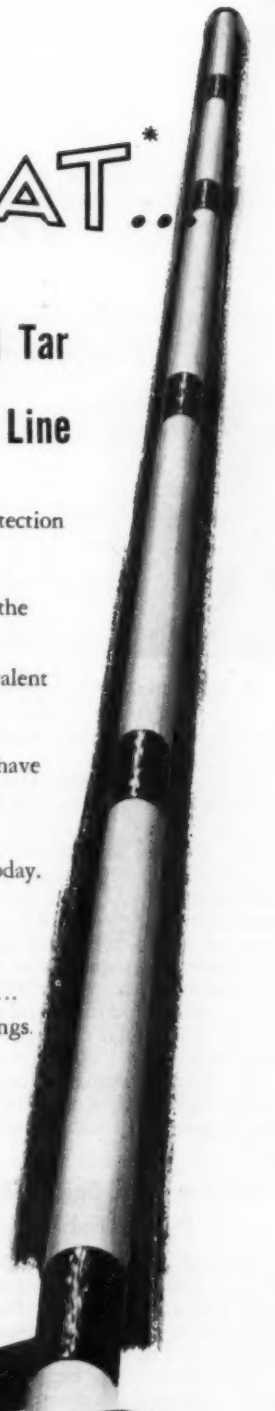

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News of the Gas Industry

Changes Announced by Firm Of H. Emerson Thomas

A. E. Wastie

H. Emerson Thomas and Paul E. Peacock, Jr., have announced that the latter has resigned as vice-president and chief engineer of H. Emereon Thomas and Associates, Inc., Westfield, N. J., to engage as an individual in LP gas engineering. He will be located in Westfield, N. J., P.O. Box 268.

H. Emerson Thomas and Associates, Inc. will continue to operate at its present location, 111 Quimby St., Westfield.

Mr. Thomas announced that Arthur E. Wastie will replace Mr. Peacock as vice-president and chief engineer of the corporation. Mr. Wastie has had many years of experience in LP gas engineering, having formerly been manager of the eastern office of Phillips Petroleum Co. on utility and industrial plants. Also he was in a similar capacity with Pacific Gas Corp.

Mr. Wastie, who is a licensed professional engineer, has engineered many of the larger utility LP gas plants in the east.

Horton and Bailey Advance At Pacific Public Service

Election of J. K. Horton to the newly created position of executive vice-president was announced by Pacific Public Service Co. following a recent meeting of the board of directors.

Mr. Horton has been secretary and legal counsel of the company since 1945, and a director of the company's subsidiary, Coast Counties Gas and Electric Co., since 1948.

At the same meeting A. R. Bailey was elected a vice-president. Mr. Bailey has been a director since 1949, and vice-president in charge of operations of Coast Counties since 1948.

Rockwell Elects

Rockwell Manufacturing Co., Pittsburgh, has announced election of Munro Corbin as controller and I. C. Rowe as secretary.

L. A. Dixon, vice-president, meter and valve division, has been elected a director of the company.

Robert M. Poe Made President Of American Gas Journal

Robert M. Poe was elected President and treasurer of American Gas Journal, Inc., on March 23 at a meeting of the magazine's board of directors. Other officers remain the same.

Mr. Poe succeeds his father, the late E. Holley Poe.

Trembly Appointed V-P of Sales At Philadelphia Gas Works

Frank H. Trembly, Jr., has been appointed vice-president in charge of sales of The Philadelphia Gas Works Co., according to an announcement by Hudson W. Reed, President.

With 27 years experience in the gas industry, Mr. Trembly has been sales manager and director of Philadelphia Gas Works since 1949, when he succeeded the late H. S. Christman.

Mr. Trembly was chairman of American Gas Association, Industrial and Commercial Gas Section, and vice-president of AGA during 1938-39. He was President of the Pennsylvania Gas Association in 1946-47.

Graduated from Carnegie Institute of Technology in 1924 in chemical engineering, Mr. Trembly was employed by the Surface Combustion Corp. in engineering and sales work before joining Philadelphia Gas Works in 1931. He served as supervisor of the industrial division and assistant sales manager prior to his appointment as sales manager.

Hinchey Now Chairman of Board As West Texas Promotes Six

R. F. Hinchey, President of West Texas Gas Co., Lubbock, Texas, was named chairman of the board of directors at a meeting in Kansas City recently. C. I. Wall was named to succeed Mr. Hinchey as President.

Other promotions within the company were also made at the meeting: T. S. Whitis was named vice-president, transmission; H. F. Heath, vice-president, distribution; J. J. Wiley, vice-president, accounting and budget control; and R. M. Curry, assistant to the president.

Arthur S. Hall Dies

Arthur S. Hall, 75, superintendent of Springfield (Mass.) Gas Light Co., died recently. He joined the company in 1905.

Mr. Hall was President of the Guild of Gas Managers of New England in 1945.

Holmberg Is Manager of Con Ed Advertising Department

E. A. Holmberg

Edward A. Holmberg has been made manager, advertising department, Consolidated Edison Co. of New York. Mr. Holmberg, who succeeds the late Dennis S. Melvin, will work with Ray Martin, Con Edison's director of advertising.

Mr. Holmberg, widely known in electrical and gas trade circles, has been identified with Con Edison's sales activities for more than 40 years. He started with Brooklyn Edison Co. as an office boy.

He was appointed a district sales manager in 1924 and from that time on advanced through a series of executive posts, all concerned with sales and promotion.

Smith, Edquist, Cartwright Promoted by Amarillo

On March 13 W. L. Smith was named vice-president and general manager of Amarillo (Texas) Gas Co. and M. B. Edquist was named vice-president in charge of distribution operations.

Mr. Smith started with Amarillo Gas in 1927. He transferred in 1932 to West Texas Gas Co., an affiliate, and served as manager of the Canyon district. He transferred again in 1932 to Amarillo Oil Co., another affiliate, as an accountant, and later became an assistant auditor. In 1948 he returned to Amarillo Gas as assistant to the president.

Mr. Edquist commenced work for Amarillo Gas in 1935 immediately following his graduation from the University of Kansas, where he majored in chemical engineering. In 1940 he was made assistant utilization engineer in the service department and in 1946 he became utilization engineer.

Thos. F. Cartwright was named a vice president of Amarillo Oil Co., in March.

Mr. Cartwright started his career in the gas industry in 1929 as an auditor for Southwestern Development Co. He transferred to Amarillo Oil Co. as auditor in 1931, assumed the duties of general auditor in 1937 and was made controller in 1948.

Appliance Dealer Sales High On Peoples Natural Lines

Appliance dealers on lines served by The Peoples Natural Gas Co. reported record-breaking sales of 19,149 gas ranges, 16,493 automatic gas water heaters, and 991 gas dryers in the 10-month period between March 1 and December 30, 1950, according to Charles L. Yost, sales manager.

The survey, conducted and correlated by the company's dealer relations staff, incorporates sales made by dealers since Peoples left the gas appliance merchandising field on March 1 of last year.

Mr. Yost pointed out that, projected on a yearly basis, the figures indicated 11 per cent of Peoples' customers had bought new gas ranges in the 10-month period and that 10 per cent had purchased new automatic gas water heaters.

Sales of gas dryers, he said, would have been considerably higher if more had been available.

Amer. Natural Signs Contract To Buy From Mich-Wis

William G. Woolfolk, chairman of American Natural Gas Co., recently has announced the signing of a contract intended to increase by 200,000,000 cu. ft. a day the future supply of natural gas to the company's transmission and distribution system.

The additional gas is to be purchased by the Michigan-Wisconsin Pipe Line Co., a subsidiary of American Natural, from the Gulf-Michigan Gas Transmission Corp., a new company that will build a pipe line from Louisiana to northern Indiana.

It is estimated that the new line will be completed and in operation in the latter part of 1952.

The additional gas supply will augment the volume of natural gas which Michigan-Wisconsin Pipe Line Co. delivers to its affiliates, Michigan Consolidated Gas Co. and Milwaukee Gas Light Co., and to non-affiliated utility companies in Michigan and Wisconsin.

Upon completion of the new pipe line, the American Natural Gas system will be able to deliver to its customers a daily maximum of more than one billion cu. ft. of gas during periods of peak demand.

In announcing the signing of the new contract, Mr. Woolfolk said:

"The agreement with the Gulf-Michigan Gas Transmission Corp. will considerably increase the gas available to all areas served by the American Natural system. It will provide additional gas for important communities whose industries and citizens will play a major part in the Nation's defense mobilization."

An application for permission of the Federal Power Commission to construct the new pipe line will be filed soon by the Gulf-Michigan Gas Transmission Corp.

The Gulf-Michigan line will transport natural gas gathered in the Gulf Coast area of Louisiana and Texas, northward past St. Louis to a connection with the Michigan-Wisconsin pipe line near Michigan City, Ind.

The line will have an initial capacity of 350,000,000 cu. ft. per day. It will supply additional quantities of natural gas to St. Louis, now served by a transmission line of the Mississippi River Fuel Corp.

Michigan Consolidated Gas Co., a subsidiary of American Natural, will receive additional volumes of gas, and so will Milwaukee Gas Light Co., also a subsidiary.

The new line will also increase the gas supply to nine non-affiliated utility companies who receive gas from Michigan-Wisconsin for distribution in 46 communities in Wisconsin and Michigan.

Gas Water Heater Shipments Continue High

Shipments of automatic gas water heaters during February 1951, approximated 215,000 units and were 37.4 per cent greater than the shipments of 156,500 units in February 1950. Shipments during the first two months of this year are estimated at 443,100 units as compared with 288,000 units during the same period of last year.

The latest figures available on electric storage water heaters relate to January 1951, when shipments totaled 95,500 units. Automatic gas water heater shipments during January totaled 228,100 units.

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American Meter Promotes Geo. W. Stevenson

G. W. Stevenson

The American Meter Company has announced the appointment of George W. Stevenson as manager of its Los Angeles factory.

Mr. Stevenson was born in Portland, Oregon. He joined the San Francisco branch of the American Meter Company in August 1928.

In February 1936 he was transferred to the Los Angeles office in the capacity of sales engineer. He was later appointed assistant manager of the Los Angeles office, and served in that capacity until his present promotion.

Colin C. Simpson Retires From Con-Edison

Colin C. Simpson, assistant vice-president of Consolidated Edison Co. of New York, and a recognized authority on gas distribution, retired on March 1 after more than 40 years of public utility work.

Mr. Simpson, who is 65, began his career as a surveyor's rodman during school vacations. His rise was rapid and before his thirtieth birthday he was general superintendent of mains and services for the Consolidated Gas Co., later to become Consolidated Edison.

At that time his work was complicated by the fact that both New York City and the gas business were having growing pains. New areas of the territory were being developed for residential and industrial purposes, while the construction of New York's subway systems presented new and involved problems of relocating existing gas mains without interruption of service to customers. Also, as smaller gas companies merged with Con Gas, it was Mr. Simpson's job to link the mains into an integrated city-wide system.

The industry generally recognized his authority in the fields of design, operating procedures, fault handling and the cause and cure of gas explosions.

FPC Authorizes Kansas-Nebraska To Expand Pipe Line System

The Federal Power Commission has authorized Kansas-Nebraska Natural Gas Co., of Phillipsburg, Kansas, to construct pipe line facilities which will increase the capacity of its natural gas transmission system from approximately 146,000,000 cu. ft. per day to about 164,200,000 cu. ft. daily.

The construction is to provide additional capacity to meet increased demands of existing markets and to serve new markets in north central Nebraska. Estimated cost of the project is $5,210,266.

Heating Unit Shipments High During Two Months of 1951

Industry shipments of gas-fired central heating equipment in February 1951 totaled 55,100 units, or 23.3 per cent greater than the 44,700 units shipped during February 1950. Shipments during the first two months of this year totaled 108,000 units as compared with 78,500 units during the similar period of last year.

February 1951 gas-fired central heating shipments were divided as follows: gas-fired furnaces, 35,300 units; gas boilers, 6,700 units; conversion burners, 13,100 units.

The latest available figures on oil-fired installations relate to January 1951. During that month there were 40,000 installations, 18,500 of which were conversion burners.

20-Ton Water Chiller Announced By Servel, Inc.

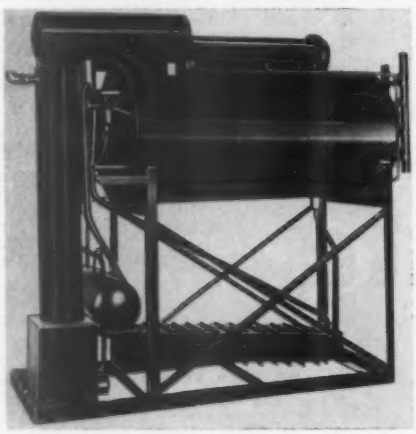
Production of an absorption-type water chiller with a capacity of 20 tons or more, for use with air conditioning units or in manufacturing processes has been announced by Servel, Inc.

John A. Gilbreath, air conditioning sales manager, reported the unit's nominal refrigeration capacity rating is 20 tons when it supplies chilled water at 45 degrees, and uses 360 pounds of steam per hour, and condensing water at a temperature of 85 degrees. If condensing water is available at temperatures below 85 degrees, or more steam is supplied, the result will be more than 20 tons of capacity.

The 20-ton water chiller is aimed at the many buildings and industries that have a need for controlled temperature and humidity.

The new unit is designed to deliver refrigeration in the form of chilled water, which is piped to separate air conditioner units, containing filters, coil and fan. For winter operation, hot water may be supplied through the same piping system.

The 20-ton water chiller is 30 inches wide and less than eight feet long, occupying only 19 sq. ft. of floor area.



New Servel water chiller.

Hughes Now General Manager Of Bryant Heater

J. A. Hughes

Lyle C. Harvey, President of Affiliated Gas Equipment, Inc., Cleveland, recently announced the election of J. A. Hughes as a vice-president of Affiliated Gas Equipment, Inc., and his appointment as general manager of the Bryant Heater Division which operates plants in Cleveland, Indianapolis and Tyler, Texas.

From 1940 to 1944 Hughes held the position of assistant to the President and industrial relations director of American Shipbuilding Co. In 1944 he became a member of the staff of Dresser Industries, Inc.

In 1949 Hughes joined Bryant as assistant general manager, a post he has held until now.

AGA Cooking Exhibit To Be Held At Restaurant Exposition

Nineteen manufacturers of commercial cooking equipment are cooperating with the American Gas Association, Industrial and Commercial Gas Section, in the combined commercial cooking exhibit at the National Restaurant Exposition to be held on the Navy Pier in Chicago, May 7-11, 1951.

Natural Gas . . . Northwest

(Continued from page 20)

for residential use from 36 per cent to 11 per cent. The very substantial increase in commercial and industrial sales means the displacement of oil, which will apply also to the anticipated increased volume of space heating business.

At the moment, we are most concerned with seeing that provisions are made to assure the continuity of our industrial operations, and particularly the plants that produce materials essential to national defense. When this emergency is over, and we again are able to offer power to all industries interested in coming here, natural gas will fill the present gap in the supply of low cost thermal units.

I should properly add that such additional competition as natural gas in the Northwest will offer to electric energy will be highly beneficial to both the electric industry and the general economy. The business that may be diverted from electric energy to natural gas will not be missed by the electric power industry, since it will largely mean converting unprofitable or low profit business to more valuable industrial utilization.

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Program Plans Announced For SGA Convention

The 43rd annual convention of the Southern Gas Association will be held April 23-25 at the Buena Vista and Edgewater Gulf hotels, Biloxi, Miss.

A chief attraction will be an address by D. A. Hulcy, President, American Gas Association, entitled, "A United Gas Industry Speaks."

Members of the Accounting Section will hear a review of the "Excess Profits Acts of 1950" by W. G. Peavy, Barrow, Wade, Guthrie & Co., Dallas; "Governmental Regulations in Industry," Scott Hughes, vice-president, Southern Union Gas Co., Dallas; "Profit Making Procedures," B. J. Jackson, Price, Waterhouse & Co., St. Louis; and a panel discussion on "Consumers' Deposits and Gas Service Contracts," presided over by W. R. Stephens, Lone Star Gas Co., Dallas.

The Distribution Section will hear two panel discussions: "Mechanization—a Challenge to Present-Day Labor Problems," C. R. Newlin, New Orleans Public Service, moderator; and "Effect of Material Controls and Allocations on Distribution System Operations," led by Fred D. Bradley, Southern Union. "The Effect on Gas Loads of Effective Mean Temperatures vs Actual Mean Temperatures," will be presented by C. B. Gamble, Jr., Alabama Gas Co., Birmingham. Aubrey L. Randall, General Motors Corp., Dallas, will present, "Maintenance of Automotive Equipment."

The Employee Relations Section will hear the panel discussion: "Employee Development," led by Earl Planty, executive consultant, Johnson and Johnson, New Brunswick, New Jersey. J. J. Healy, Harvard Business School, Boston, will discuss, "Labor Relations in a Mobilized Economy."

Highlights of the Sales Section include: "Keeping the Public Sold of Gas —an Industry Responsibility," by W. L. Hayes, general sales manager, Montana-Dakota Utilities, Minneapolis; "Automatic Range Ignition Program," by James I. Gorton, GAMA; "Here's Factual Proof," Marshall W. Batchelder, Caloric Stove Corp., Chicago.

The Residential Sales Section will feature a panel discussion led by C. Ross Walker, United Gas Co., New Iberia, La., entitled, "The Clothes Dryer," and a speech, "Selling Gas Refrigerators in Today's Markets," by John K. Knighton, general sales manager, Servel, Inc. Earl Lifschey will discuss "House to House Selling."

The Commercial Sales forum will hear: "Good Selling is Good Public Relations," Fred A. Kaiser, President, Detroit Michigan Stove Co.; "Comparison of Competitive Equipment," Walter B. Kirk, chief research engineer, AGA laboratories; and "Misuse and Abuse of Heart of Commercial Cooking Equipment—Thermostats," W. D. Mastin, Robertshaw-Fulton Controls Co.

The Industrial Sales forum will feature "Conversion of Diesel Engines to Dual Fuel," by John Berggren, President, Diesel Modifications, Inc.; "Gas Turbine Generating Units," M. E. Orelup, Oklahoma Natural Gas Co.; "Large Volume Air Conditioners," W. H. Steitler, Carrier Corp.; "Industrial Development," Burnie Porter, United Gas Pipe Line Corp.

A panel discussion concerning television will highlight the advertising forum. M. W. North, of Oklahoma Natural Gas Co., Tulsa, will moderate.

Speakers for the Transmission Section will be E. B. Dunn, Keystone Pipe Line Co., Philadelphia, on "Installation and Use of Micro-Wave on Pipe Lines," and R. C. Ledford, manager, Marine Gathering Co., Houston, on "The Design and Construction of Off-Shore Pipe Lines." There will also be a panel discussion on transmission operating problems, with Carl E. Cloud of Oklahoma Natural as moderator.

The program will also include reports by SGA President Carl H. Horne and managing director, Robert R. Suttle.

Section chairmen for 1951-52, who will take over after the convention, have been announced as follows: Accounting, W. M. Wampler, Chattanooga; Distribution, H. R. Derrick, Birmingham; Employee Relations, Harold F. Taylor, Tulsa; Sales, J. O. Jackson, Houston; Transmission, Aubrey L. Roberts, Owensboro; General Convention, Dale E. Frieden, Alva, Okla.

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VULCAN DIAPHRAGMS *need no oiling!*

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(Continued from page 26)

and C. These are baked at various temperatures, but usually at about 400°C.

Because glass thickness (and therefore heat capacity) is much less in the neck at A than in the face B, uniform heat application brings thin sections to temperature sooner than heavier sections. This results in uneven expansion, with frequent breakage at the seal line C. The effort to minimize this expensive "shrinkage" had resulted in long and costly ovens.

When men from the lamp industry were brought into television work, they reasoned that radiant burner patterns could here also equalize differential heating rates. After rather extensive investigations, production installations were made, and now a number of radiant gas processing units are used in this field—nearly all of which have supplanted larger electric ovens. For the same rate of production, these radiant gas units require less floor space, less energy and much less time. Most important, "shrikage" has been reduced substantially.

"Dropping" and Annealing Glass Panels

Many convex glass objects are formed by heating flat glass plates or discs to the softening point and permitting them to drop by gravity or by forcing them into molds with shaped plungers. In this way flat glass is converted into clock crystals, reflecting bowls for lamps and curved automobile windows.

Traveling horizontally through the heating chamber in molds or mold rings, the glass is rapidly and uniformly heated as it passes under flat arch radiant roofs. For a particularly difficult operation involving large and sometimes irregular shapes, one manufacturer has just installed his third radiant-roof lehr. These three lehrs have replaced less efficient muffle type units which had required appreciably longer time cycles.

If metal molds with high heat storage capacity must be heated, some bottom heating may also be required. In various patterns, one midwestern plant has added hundreds of radiant burners which improve temperature in its "dropping" lehrs.

Heating Molten Glass in Feeders

A plate glass manufacturer was faced with the problem of maintaining uniform temperatures throughout a particularly long glass feeder trough. This had to be done without agitation, because disturbance to the molten glass surface resulted in bubbles or "seeds" in the plate. Initial efforts to solve his problem involved the controlling and relocating of blast type burners. He finally succeeded, however, by mounting 12 large radiant burners above and facing down upon the flowing glass. Turbulence is now so low that the glass stream itself has the appearance of a mirrored surface, and product quality is much improved.

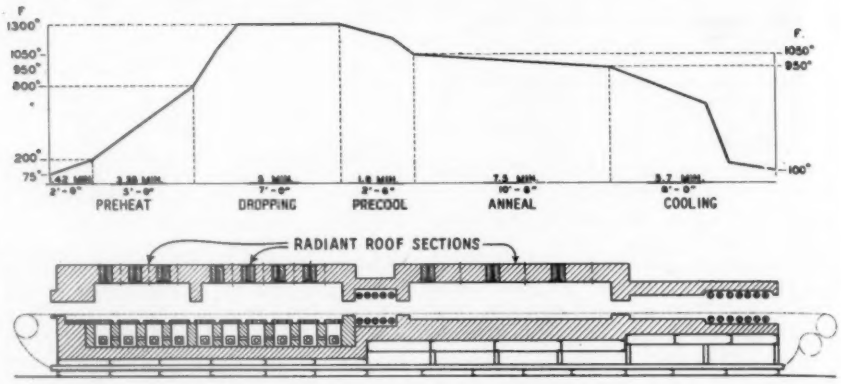


Fig. 8 Lehr for lens dropping with time-temperature curve shown. Total cycle 25 minutes.

Addition of Radiant Burners to Plate Glass Lehrs

To secure temperature uniformly across a moving strip of slowly cooling plate glass has long been a problem. As in other glass annealing processes, the customary solution has been to use longer time cycles than otherwise necessary, allowing the material to "soak" until temperatures become uniform. In the case of plate glass cooling, this resulted in annealing lehrs hundreds of feet long.

In a successful effort to increase satisfactory production without a corresponding increase in lehr and building length, one producer recently placed inverted radiant burners over the cooling glass within his existing lehrs—in patterns which offset non-uniform heat losses—and solved the immediate problem. From these results, a radiant designed lehr is indicated as a better permanent installation.

Lens Dropping

A radiant lehr has been in operation for several years dropping lenses for sun glasses: Figure 8 shows an end-to-end section of this 35-foot lehr and the corresponding time-temperature curve which indicates the separate phases of the operation. Time in the annealing section is 7½ minutes, which is only three times the theoretical minimum. This is unusually brief.

The lehr utilizes radiant roof sections with different patterns for preheating, dropping and annealing. Until they leave the dropping, section molds are heated also by tunnel burners beneath, and zones are separated by refractory walls suspended from above. Water coils are used in two cooling sections, while slow cooling through the critical annealing zone is controlled by radiant burner patterns of low intensity.

Exhausting Metal-Glass Tubes

A simple radiant furnace is used for heating metal-to-glass electronic tubes during the exhausting process. Radiant burners are arranged to operate within a divided enclosure, in which they heat the tube at close range. Radiant energy passes through the glass and is released as heat on the internal metal parts to accelerate the driving off of absorbed gases.

Forming and Annealing of Small Blanks

In the production of watch crystals a highly mechanized process employs a dial with open inverted radiant burners for pre-heating the blanks and for controlled cooling after forming. They are then transferred to a lehr heated by radiant burners from overhead. The displacement there of nozzle mixing torch flames by the radiant burner roof reduced heavy "shrinkage" to a negligible quantity.

The forming of eye-glass grinding blanks requires a comparable heating operation. Because higher heats are necessary, a rotary hearth furnace replaces the open heating dial.

Drying External Coatings

Tableware is decorated by fusing on colors of powdered low temperature glass. These are applied in a moist vehicle by the silk screen process and dried between the applications of separate colors before firing. Water tumblers being decorated are heated for predrying in less than one minute by passing them between facing rows of radiant burners, and cooled again in about two minutes by controlled air blast. This seems to be an ideal application because of the fact that radiant heat is selectively absorbed

by the opaque colors in preference to the clear glass bodies.

Conclusions

These and other accomplishments have resulted from utilizing what we have come to know as "form value." The arrangement of radiant gas heat in patterns without flame impingement, its rapid transfer, and immediate partial release within the ware itself present industry with a production tool whose usefulness has only recently been discovered. To secure its many advantages has required departure from accepted heating methods, whose continued use would have denied those advantages. New tools, new methods and new products are only possible to those who seek with open minds.

The glass industry continues to introduce new products and to invade new markets. It is certain that development and use of better heat processes have made possible at least one new glass product for which demand still far exceeds supply. Increasing use of radiant gas heating is responsible for more and better ware—at lower cost. Acceptance of these improved heat processes is increasing the glass industry's demands for a *constant supply of uniform, quality fuel.*

To what extent will these demands be satisfied by the gas industry?

Fletcher Heads AGA Distinguished Service Award Committee

R. L. Fletcher, President, Providence Gas Co., Providence, R. I., has been appointed chairman of the 1951 American Gas Association Distinguished Service Award Committee, it was announced recently by D. A. Hulcy, President, Lone Star Gas Co., and President of AGA.

Piedmont Wants To Build System To Serve No. Carolina

Piedmont Gas Co., Inc., of Hickory, N. C., has applied to the Federal Power Commission for authority to build a system of natural gas pipe lines in North Carolina connecting with the main transmission system of Transcontinental Gas Pipe Line Corp., of Houston.

The application also asks the commission to order Transcontinental to establish connections between its facilities and the proposed new facilities and to deliver the required amounts of natural gas to Piedmont.

Piedmont's proposed system of interconnecting pipes would be about 28 miles long, and would be of 6-inch pipe. The company also proposes to construct and operate metering and regulating stations at the city gates of its existing distribution systems and of distribution systems it may subsequently acquire.

Annual requirements of the proposed new system are estimated at 201,933,000 cu. ft. in the first year of operation, and at 716,916,000 cu. ft. in the fifth year.

Northern Natural Proposes To Increase System

Northern Natural Gas Co., of Omaha, has applied to the Federal Power Commission for authority to construct pipe line facilities which will increase the capacity of its natural gas system north of Kansas by 225 million cu. ft. per day to a new daily total of 825 million cu. ft.

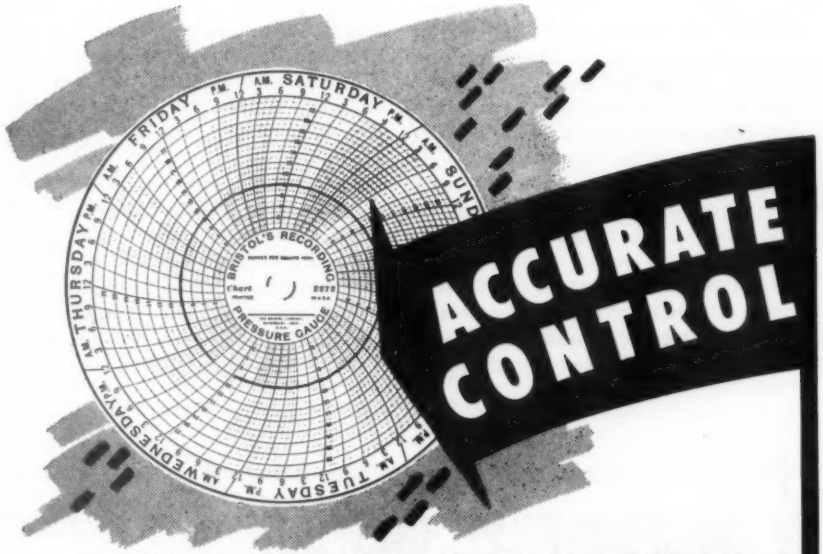
The facilities are estimated to cost $33,095,000, and consist of a total of 221.8 miles of pipe line additions in Texas, Oklahoma, Kansas, Nebraska, and Minnesota, and compressor additions totaling 84,000 hp in Texas, Kansas, Nebraska, and Iowa.

South Atlantic Seeks FPC OK For Line in Florida

South Atlantic Pipe-Lines, Inc., of Jacksonville, has asked the Federal Power Commission for authority to construct a 254-mile natural gas transmission line in Florida extending from the Jacksonville area to St. Petersburg.

The project is estimated to cost approximately $23,500,000.

The application says that preliminary studies indicate a potential firm load of approximately 115 million cu. ft. per day and an interruptible load of approximately 140 million cu. ft. per day in the fifth year of operation.



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Dead Weight or Spring Type, with or without Mercury Seal, or Dead Weight Safety Seal or diaphragm operated relief valve. All working parts are so accessible as to be interchangeable without removal from pipe line.

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For horizontal or vertical connections, with or without removable valve pocket. Available with either Spring or Dead Weight adjustment. With or without Mercury or Dead Weight Safety Seal or diaphragm operated relief valve.

Reynolds Gas Regulator Co.
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GAS CONTROL SINCE 1892

Gas Turbines

(Continued from page 16)

simple cycle, 50-500 hp for industrial purposes probably will become popular in the near future, especially where the loss in thermal efficiency is counter-balanced by low first cost, no water requirements, simplicity, less bulk and ease of operation. Future research should gradually better the present thermal efficiency obtained from small size units.

In larger size units of the simple cycle for industrial use, two American companies, after extensive testing periods, have installed or have contracted to install two gas turbine units for gas pipe line pumping; the results from these installations should prove very valuable as to the future prospects of gas turbine operation for gas pipe lines.

When the problems involved in the more efficient burning of fuels, the development of better heat resisting materials, either metals or ceramics or a combination of both, further work on liquid cooling of turbine blades, together with development of a small efficient rotary heat exchanger are solved, the way will be clear for the gas turbine to assert its technical supremacy.

Research on the technical problems is proceeding at a rapid pace, and it appears to be only a question of time before they may be solved.

A gas turbine survey recently made shows that more than 60 gas turbine units, ranging in size from 150 hp to 27,000 kw and aggregating more than 410,000 hp, are under test, now operating, under construction, or on order throughout the world.

Westinghouse Unit

A 2000 hp gas turbine unit, after a successful 2000-hour test, has been put into actual service by the Mississippi River Fuel Corp. to pump natural gas to St. Louis, Missouri.

This gas turbine is a straight-through, simple open cycle unit, direct connected to a centrifugal type gas booster pump. The unit with its auxiliaries is mounted on a single bedplate, 20 feet long by 5 feet wide by 4½ feet high, and weighs 26,000 lbs.

Free air after entering the compressor is compressed to five atmospheres, then passes into twelve tubular type combustors; natural gas is injected and burned, and the heated air and products of combustion are expanded through the turbine and exhausted into the atmosphere.

More than two-thirds of the output is consumed by the compressor, and the remaining 2000 hp is available to drive the gas booster.

There are twelve combustors, 6″ diameter by 3′0″ long, located between the air compressor and the turbine in order to provide a minimum of turning of the high velocity gases. Each combustor is interconnected for ignition purposes. The flame tube, or inner basket, is made of "25-20" chromium-nickel alloy steel sheet rolled into circular sections and spot welded together. When in operation, the flame is contained within this inner tube which is perforated to allow the air to enter for the combustion and the necessary cooling.

The temperature at the turbine end of the flame tubes and inlet to the turbine is 1350° F at full load.

The gas turbine has eight stages designed for equal heat drop over the stationary and rotating blades. The turbine rotor is machined from a solid forging of stabilized "19-9 DL" austenitic chromium-nickel stainless steel, the main section being 14½″ diameter by 24″ long.

The cylinder is also made of stabilized "19-9 DL" austenitic stainless steel which is grooved for holding the stationary blades. All bolting is of stainless steel.

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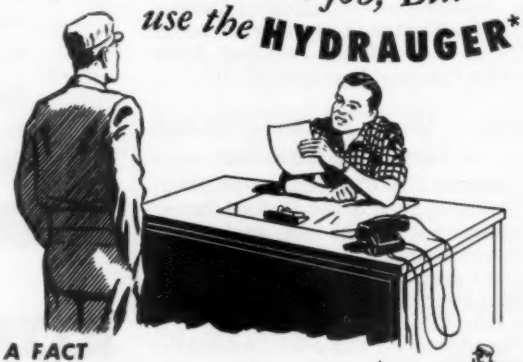

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HY-21C

These alloys were chosen as being the best obtainable for the temperature conditions.

After the 2000-hour test period, no deterioration was shown on the turbine even though continuously subjected to temperatures in excess of 1300° F. for as long as 342 hours.

Boeing Unit

Basically, the Boeing turbine comprises two major sections: the gas producer and the power-output section. The gas producer consists principally of a single-stage centrifugal compressor, two can-type burners at present designed for burning liquid fuels, and an axial-flow turbine wheel. This, the "502" 's primary stage, is a pure jet engine producing hot gases.

It is in the second section that the jet's thrust is transformed into shaft power or power output.

The gases travel from the first turbine wheel (36,000 rpm) through a nozzle box and are expanded through the second-stage wheel which drives the output shaft. The vaned wheel turns at 22,500 rpm and drives through a 9:1 reduction gear, stepping the rpm down to 2500 and producing a maximum continuous output shaft rating of 160 hp.

The absence of a mechanical connection between the two stages permits the gas-producer speed to be controlled independently of the output shaft speed, resulting in an engine with an infinitely variable transmission. This means simply that an extremely high torque can be developed on the output shaft by stalling the shaft while running the first stage at its rated speed.

The friction load is slight and starter power requirements remain nearly constant, even in sub-zero weather. It is expected that, at —65° F, the turbine can be started, warmed up and the throttle opened to full power in 60 seconds.

Another important feature of the 502 is the fact that, for virtually all applications, it will be cooled by normal circulation of air. Neither water nor forced-draft air cooling systems will be required.

Since the turbine weighs only 185 pounds without accessories, it has the unusual advantage of being able to produce one horse power for every pound of its own weight. By way of contrast, most automotive engines weigh six pounds or more per horse power.

An interesting comparison of the turbine with a Diesel engine of comparable horse power shows volume of installation space required for turbine 9.4 cu. ft.; Diesel 40.5 cu. ft. Turbine weight 185 lbs.; Diesel weight 2850 lbs.

The present drawback in this small turbine unit is its fuel consumption. The minimum fuel consumption using Diesel oil is 1.25 lbs. per bhp hour, which is about twice that of the best gasoline engines and nearly three times that of the Diesel engines.

Peoples Natural Appoints Doman Ass't Chief Civil Engineer

Roy A. Doman has been appointed assistant chief civil engineer for The Peoples Natural Gas Co., it has been announced by John Jacob, Jr., vice-president of the company.

W. E. Kirby Appointed to ESA—Formerly With American Stove

Walter E. Kirby, manager of American Stove Company's Atlantic sales division, Philadelphia, has been appointed to the Economic Stabilization Authority by a request from ESA Chief Eric Johnson. Frank S. Savage replaces him at American Stove.

Mr. Kirby has been an administrative officer of the company since 1923. He became manager of the national division in 1928, supervising production and distribution of appliances. In 1930, he was named manager of the Atlantic sales division.

Mr. Savage started as a salesman with the Atlantic division in 1934.

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One Man Operation On Every Application

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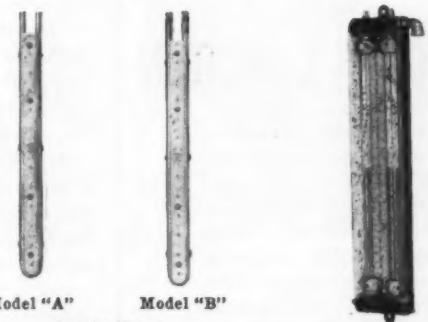

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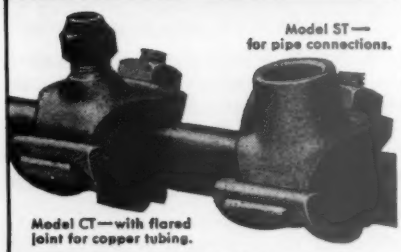

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New Insulating Brick Described By Johns-Manville Folder

A new four-page illustrated folder just published by Johns-Manville, N. Y., entitled, "JM-3000 Insulating Fire Brick," presents the industrial applications and refractory properties of insulating fire brick for sustained use at 3000°F.

Physical and thermal characteristics are given in table form. An illustrated description highlights the use of these insulating fire brick in the construction of a slot type forging furnace. The folder also contains summarized information on accessory materials and other insulating brick made by Johns-Manville.

Baird and Selander Promoted By Youngstown Sheet & Tube

Paul B. Baird of Youngstown, Ohio, has been advanced to manager of standard pipe sales for the Youngstown Sheet and Tube Co. He succeeds Glenn W. Christopher who died recently.

Carl T. Selander of Chicago, western representative for standard pipe products for the past year, has been promoted to assistant manager of standard pipe sales with headquarters in Chicago.

Contract Legalities

(Continued from page 32)

of gas into the state of Michigan, this company is within jurisdiction of the Michigan Public Service Commission. The court said:

"Obviously, Panhandle seeks to skim the cream off the local market for natural gas in the municipality where the intervening defendant now provides such services, by selling gas to Ford Motor Co. and other industrial users; without regard to the public convenience and necessity for natural gas by other users in the Detroit area, particularly for domestic use. If Panhandle is free to compete at will for such local markets, and take the cream of the business, any other utility providing the same service in the same area might be forced to obtain higher rates for its services when it must obtain its natural gas from Panhandle, and thus would face a distinct disadvantage. The right to exclude such competition, where the general public convenience and necessities so require, has been delegated by the legislature to the Michigan Public Service Commission. It is within the power of that commission, to determine whether Panhandle, by selling natural gas direct to industrial users in Detroit, would thus serve the public convenience and the necessities of users of natural gas in that area."

This court quoted further:

"The controlling issues therefore are two: (1) Has Congress, by enacting the Natural Gas Act in effect forbidden the states to regulate such sales as those appellant makes directly to industrial consumers: (2) if not, are those sales of such a nature that the commerce clause of its own force forbids the states to act? We think there can be no doubt of the answer to be given to each of these questions, namely, that the states are competent to regulate the sales."

Question: If a gas corporation's employes use care and place lighted lanterns on a sidewalk barrier which warns pedestrians of excavations, is the gas corporation liable for damages for injuries sustained by pedestrians if unknown persons steal the lanterns from the barrier?

Answer: Yes, according to a recent higher court, if the testimony shows that the gas corporation violated a city ordinance.

For example, in Bertolozzi v. Progressive Co., 212 Pac. (2d) 910, it was shown that a city ordinance provides that everyone who performs work dangerous to pedestrians must erect and maintain a substantial barrier, and that they must place reflectors on the barrier.

One night a pedestrian sustained serious injuries when he walked into a framework of boards placed on a sidewalk. The mishap occurred in the night time. The company proved that its employes had placed lanterns on the barrier, but that someone had stolen the lanterns.

The higher court held the company liable in damages to the pedestrian, and said:

"Where a statute or ordinance is clear on its face there is no room for extrinsic evidence of its meaning. . . . By its express terms the ordinance required a reflector device on the barrier. Admittedly defendants (company) had placed no such device on the barrier here involved."

Question: Who has legal authority to decide legal controversies involving the wholesale distribution of gas in interstate commerce?

Answer: In Michigan Consolidated Gas Co. v. Panhandle Eastern Pipe Line Co., 173 Fed. (2d) 784, the higher court held, as follows: The Federal Power Commission has authority to prescribe reasonable regulations relating to the adequacy and impartiality of service in distribution of gas. A court cannot decide questions respecting the construction of facilities and distribution of gas by a gas utility until authority of Federal Power Commission had been invoked to the full extent of its regulatory powers.

This court also held that the underlying purpose of the Natural Gas Act was to provide an agency for regulating the wholesale distribution to public service companies of natural gas moving interstate.

Otis Joins West Coast Branch Of Robertshaw-Fulton

W. E. Otis has been named administrative assistant to H. W. Geyer, director of the Robertshaw-Fulton Control Company's West Coast research and development laboratory.

Mr. Otis was formerly with the Southern California Gas Co. where he developed and administered that company's field observation program. This program has received considerable recognition as an agency through which field usage reports are accumulated for review with involved manufacturers and ASA approval committees.

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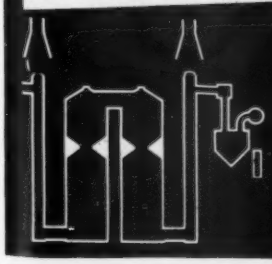

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- WATER GAS MACHINES
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- GAS PURIFIERS
- CONDENSERS
- WASTE HEAT BOILERS
- PRODUCER GAS PLANTS
- HIGH BTU OIL GAS PLANTS

CONVENTION CALENDAR

April

16-18 AGA Distribution, Motor Vehicles and Corrosion Conference, Hotel Peabody, Memphis.
16-18 GAMA, annual meeting, Drake Hotel, Chicago.
19-21 Florida-Georgia Gas Association, spring convention, Hollywood Beach Hotel, Hollywood Beach, Florida.
23-25 Southern Gas Association, Biloxi, Miss.
26-27 Indiana Gas Association, French Lick Springs, French Lick, Ind.

May

4 New Jersey Utilities Association, spring meeting, Seaview Country Club, Absecon, N. J.
7-8 AGA Natural Gas Department, spring meeting, Baker Hotel, Dallas.
14-16 AGA Production and Chemical Conference, Hotel New Yorker, New York.
15-17 Pennsylvania Gas Association, Wernersville, Pa.
17-19 Public Utilities Advertising Association Convention, Hotel New Yorker, New York.
21-23 Missouri Association of Public Utilities, annual convention, Jefferson Hotel, St. Louis.
27-30 American Society of Refrigeration Engineers, Spring Meeting, Hotel Statler, Detroit.

June

18-21 Canadian Gas Association, Bigwin, Lake of Bays, Ontario.
25-26 Michigan Gas Association, The Grand Hotel, Mackinac Island, Mich.

September

4-6 PCGA Convention, Fairmont Hotel, San Francisco.

October

15-17 AGA Annual Convention, St. Louis.

Robert Buck Becomes Manager Of Bryant Industrial Div.

Robert M. Buck has been named to succeed D. A. Campbell as manager of Bryant Heater's industrial division. The announcement was made in a statement released by J. N. Crawford, director of sales, from the company's headquarters in Cleveland, Ohio.

Mr. Buck has been closely associated with industrial gas-fired equipment since 1929 when he first joined the industrial department staff of the Michigan Consolidated Gas Co. of Detroit. During the period from 1938 to 1944 he served as industrial laboratory supervisor for Michigan Consolidated and was engaged in industrial research and development and technical combustion applications. He joined the Bryant industrial division in 1944 as division engineer and is credited with many industrial combustion developments now applied by industry.

Authorization For 77-Mile Line Sought by National Utilities

National Utilities Co. of Michigan is seeking Federal Power Commission authorization to construct approximately 77 miles of pipe line to carry natural gas into the area it serves in south central Michigan.

The application also asks FPC to order Panhandle Eastern Pipe Line Co., of Kansas City, Mo., to connect its pipe line system with the facilities proposed to be built by National Utilities, and to sell natural gas to the latter company.

The proposed new system, estimated to cost approximately $1,500,000, would have a daily capacity of about 11 million cu. ft.

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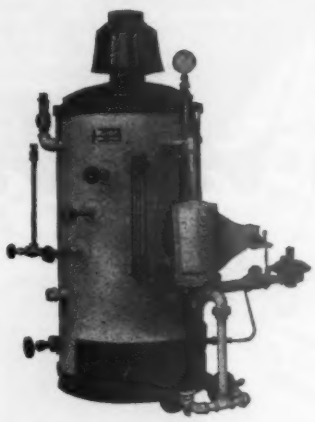

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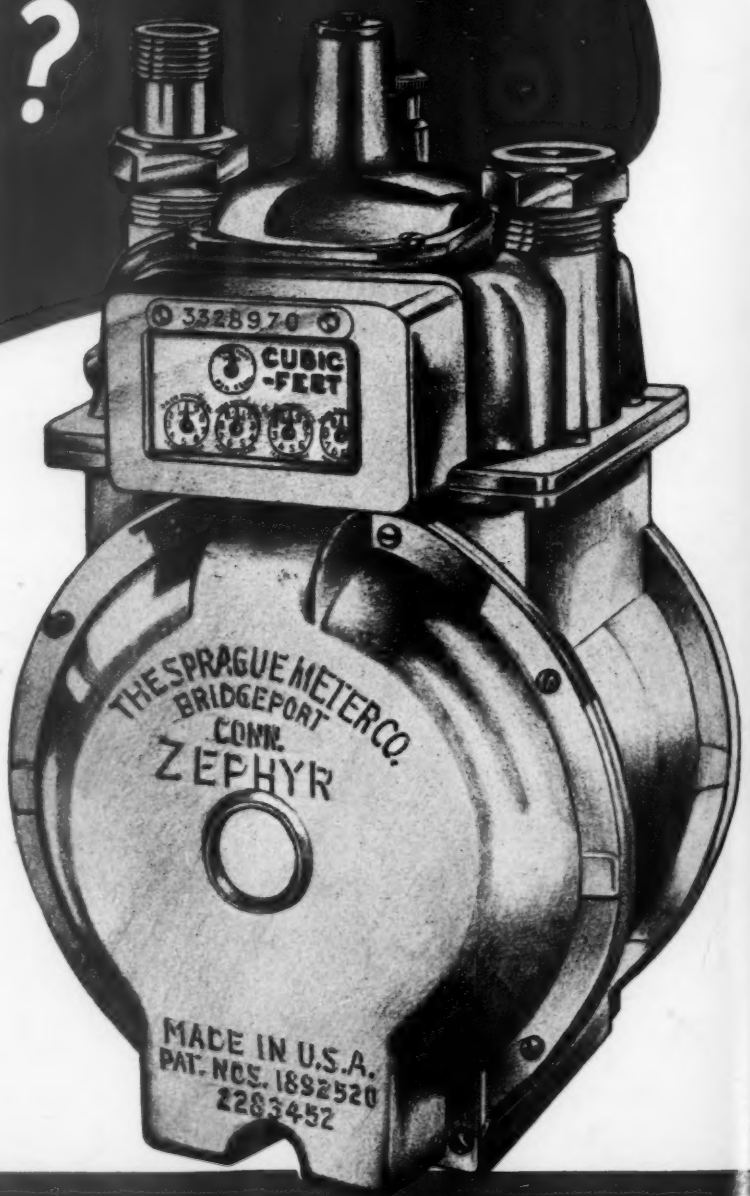

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